The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D.

September 1944

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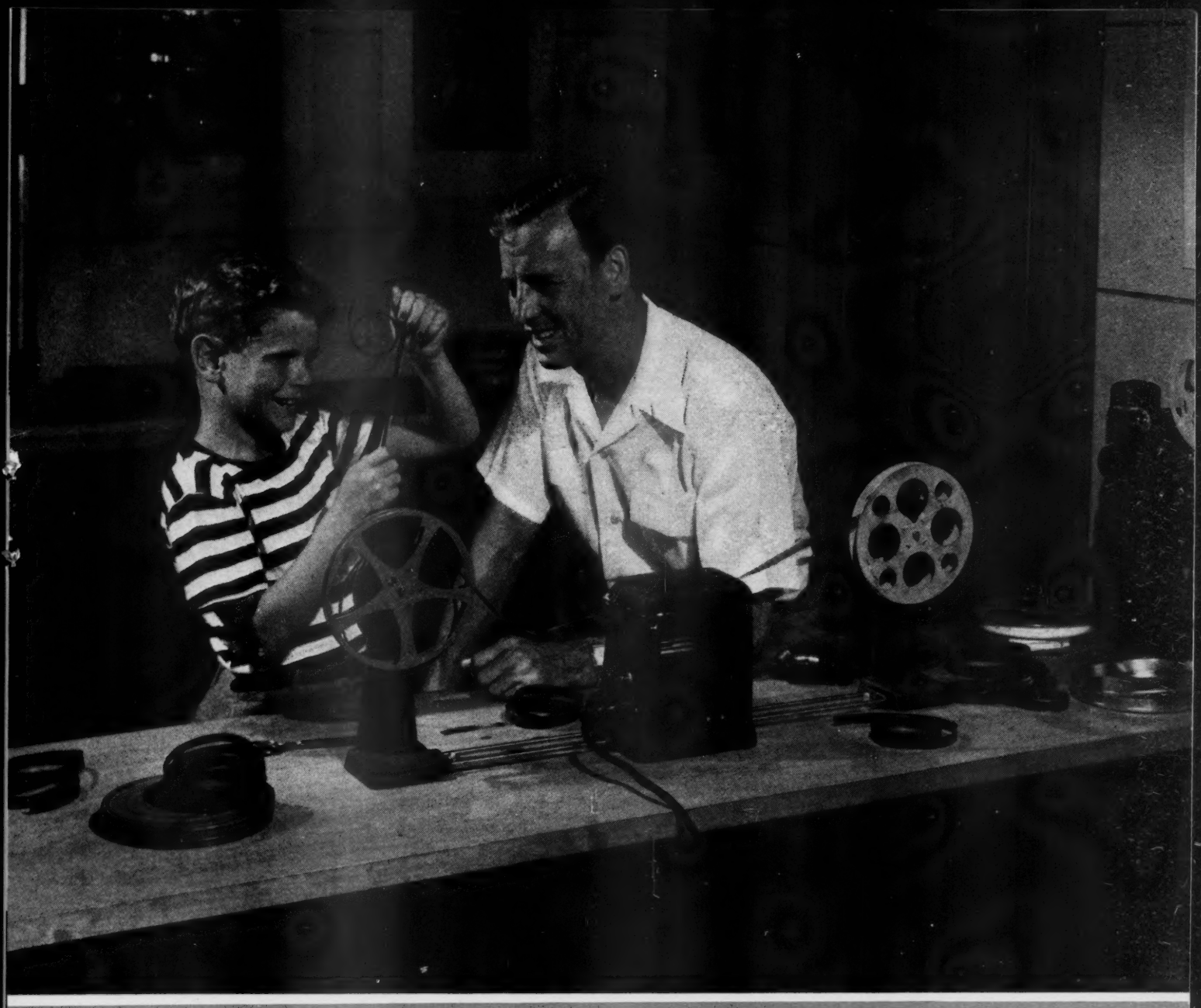

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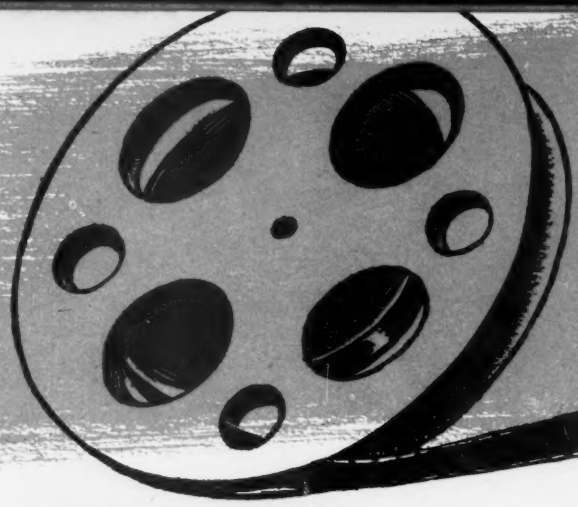

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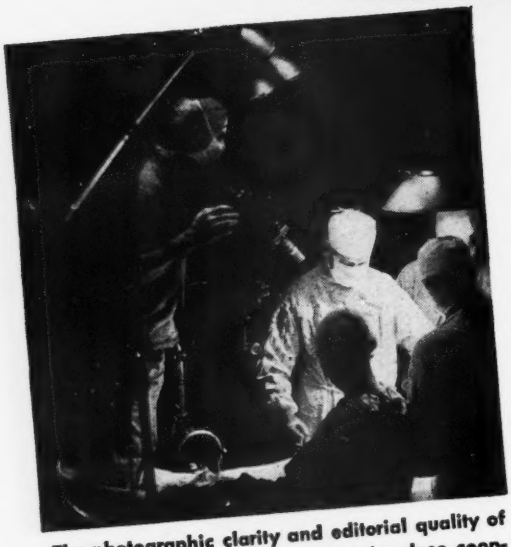

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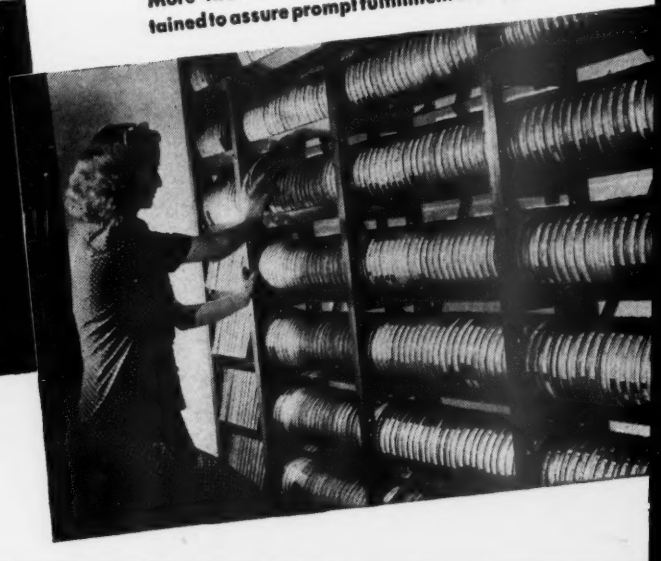

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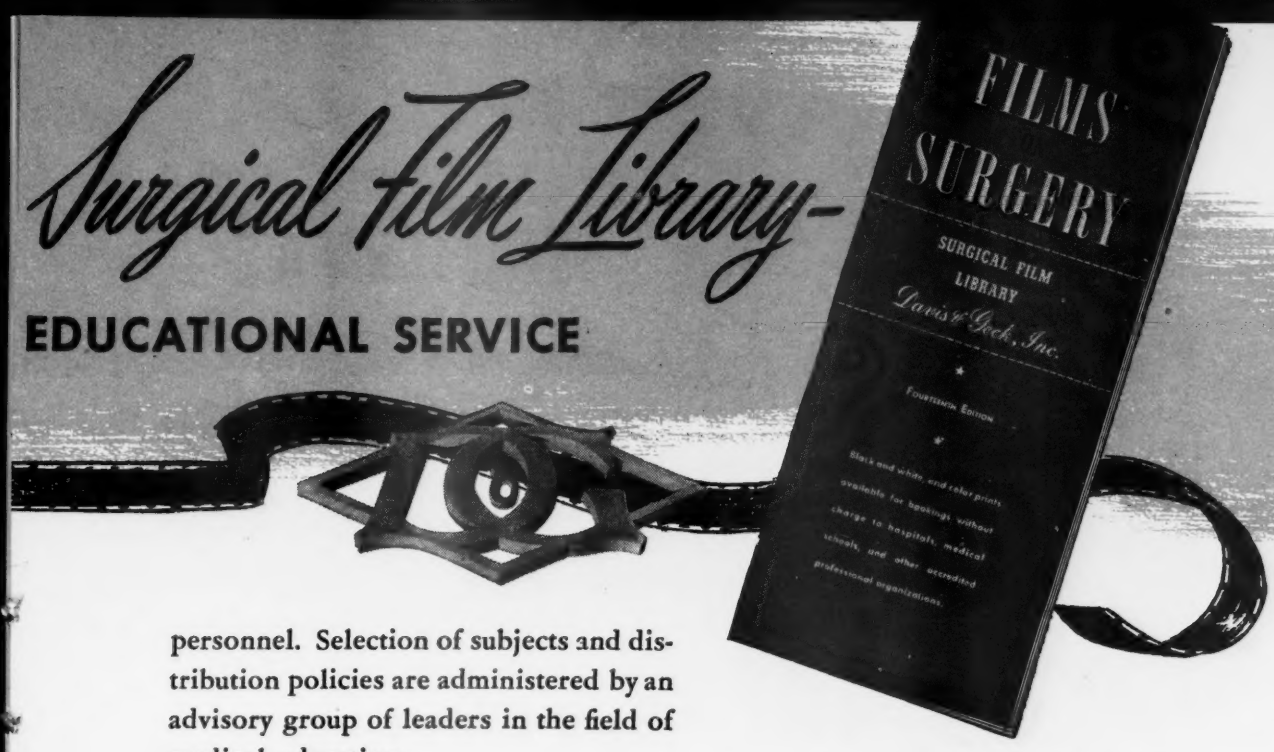
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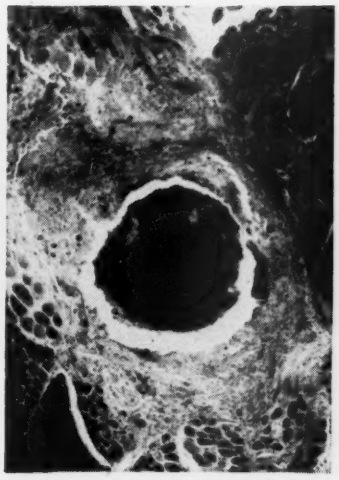

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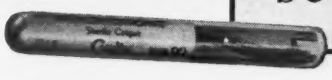

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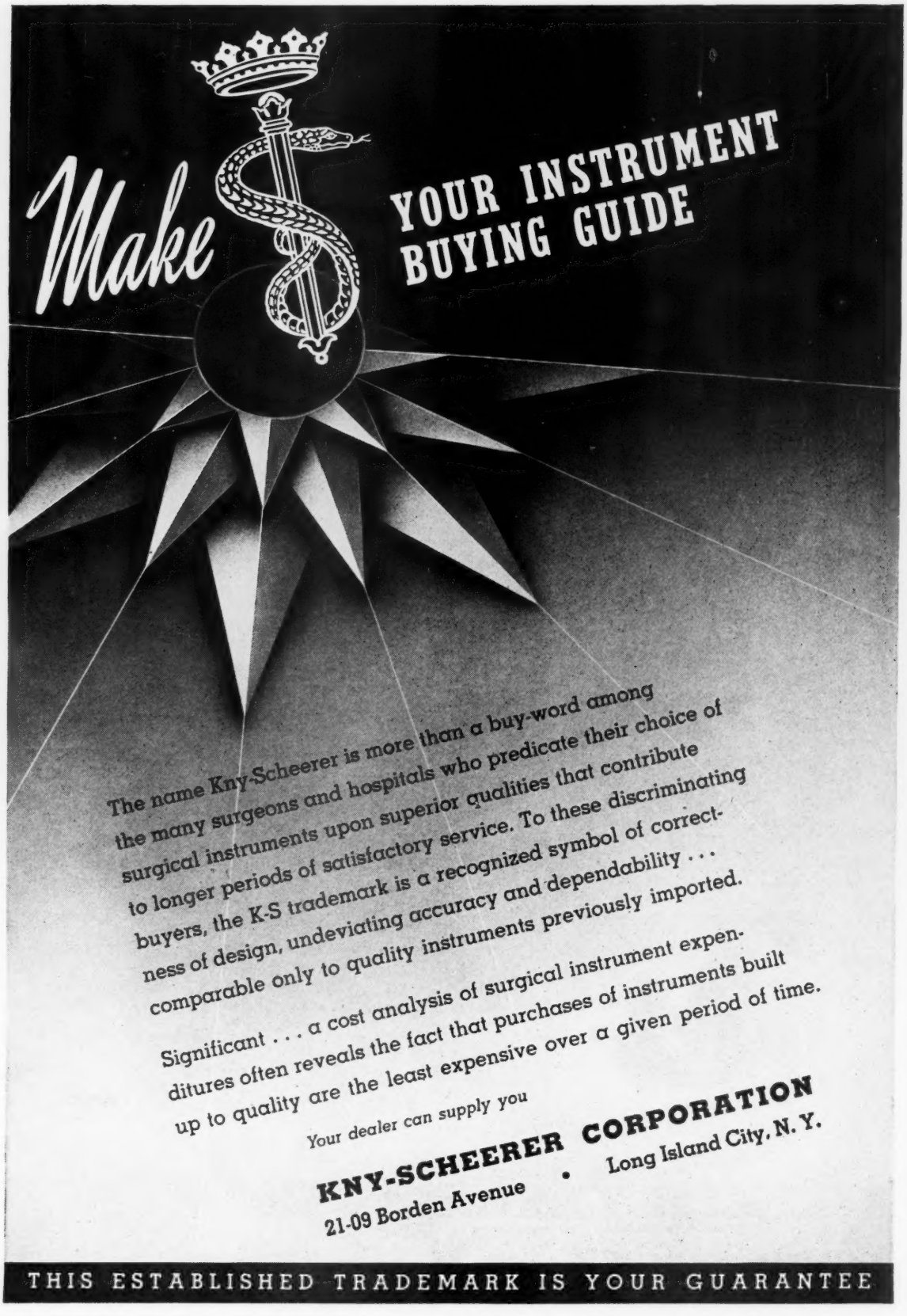
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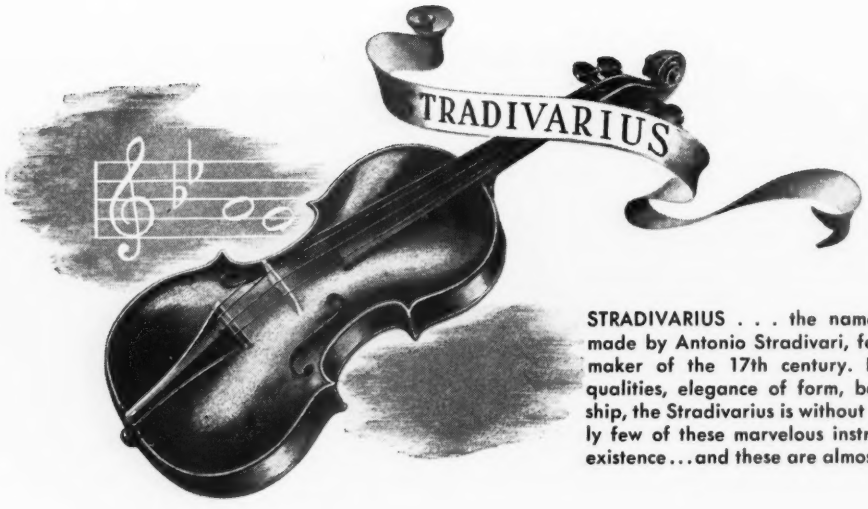

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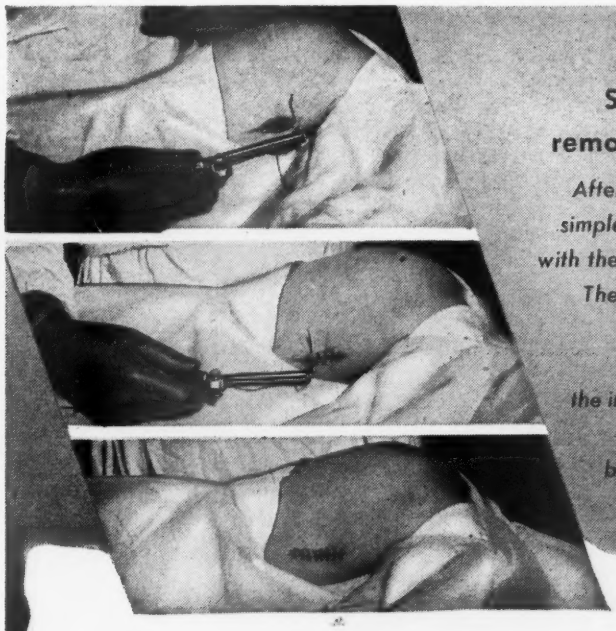

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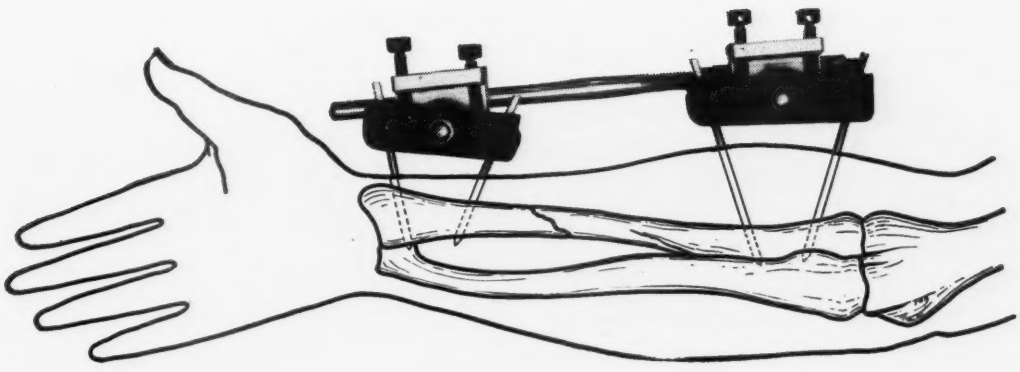

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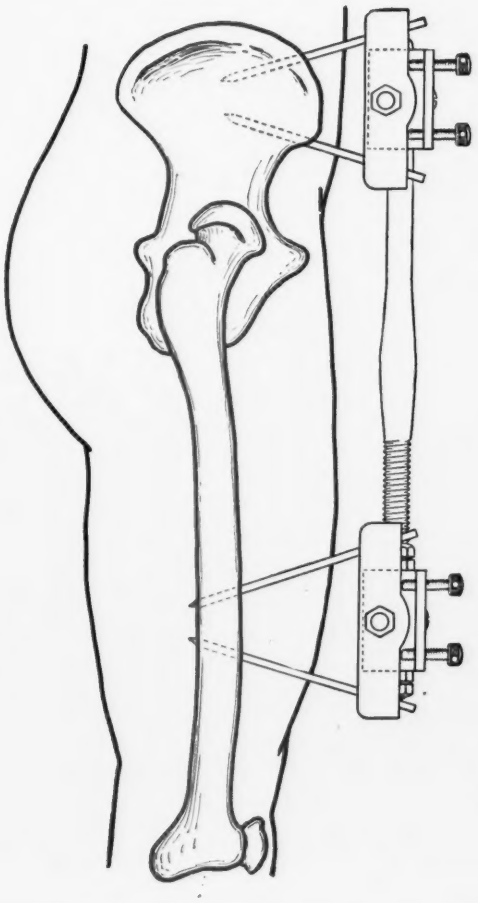

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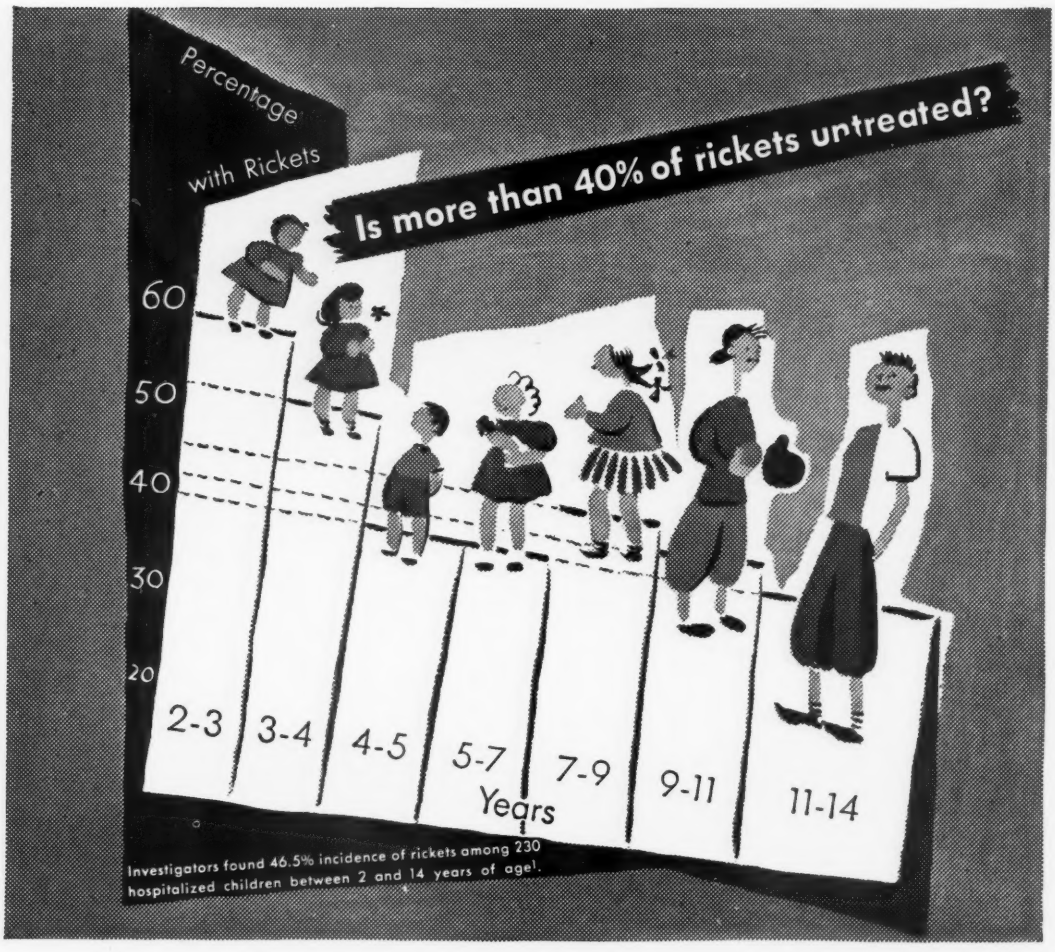

It used to be thought that rickets is prevalent only in the first two years of life. This was when the roentgenological and clinical manifestations were accepted as the criteria for diagnosis. Recent studies suggest that perhaps as the result of this impression, as much as 40% of rickets has gone untreated.[1]

Microscopic examination of the long bones of children between the ages of 2 and 14 who died from various causes showed a startlingly high percentage of cases of rickets in older children. The highest incidence was found during the third year (57%). This suggests the need of continuing vitamin D supplementation beyond infancy. Evidently, as long as growth persists, and at least through the fourteenth year, administration of vitamin D should be made routine; because even in children who *appear* healthy, histologic bone studies show that disturbances in calcium-phosphate metabolism are fairly common.

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1. Follis, R. H.; Jackson, D.; Eliot, M. M., and Park, E. A.: Am. Jrl. Dis .Child. 66:1 (July) 1943. Note: A reprint of this paper is being mailed to all physicians. Additional copies are available upon request.

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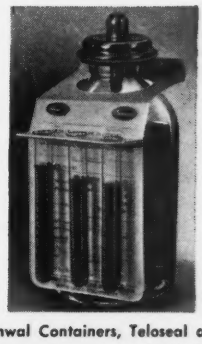

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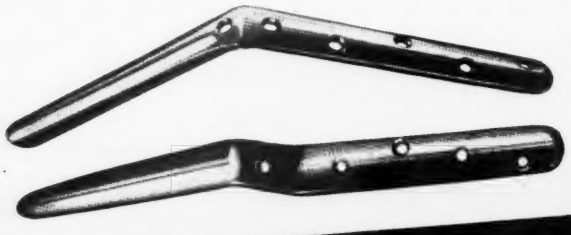
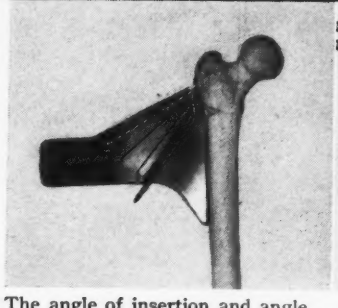


The Moore Single-Angle Blade-Plate for fixation of trochanteric fractures.

The Blount Double-Angle Blade-Plate for fixation of high femoral osteotomies.



The angle of insertion and angle of the osteotomy are conveniently measured with this protractor.

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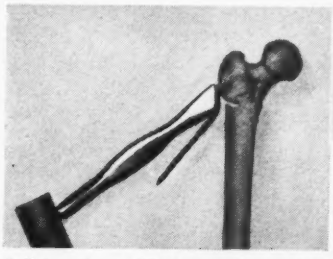

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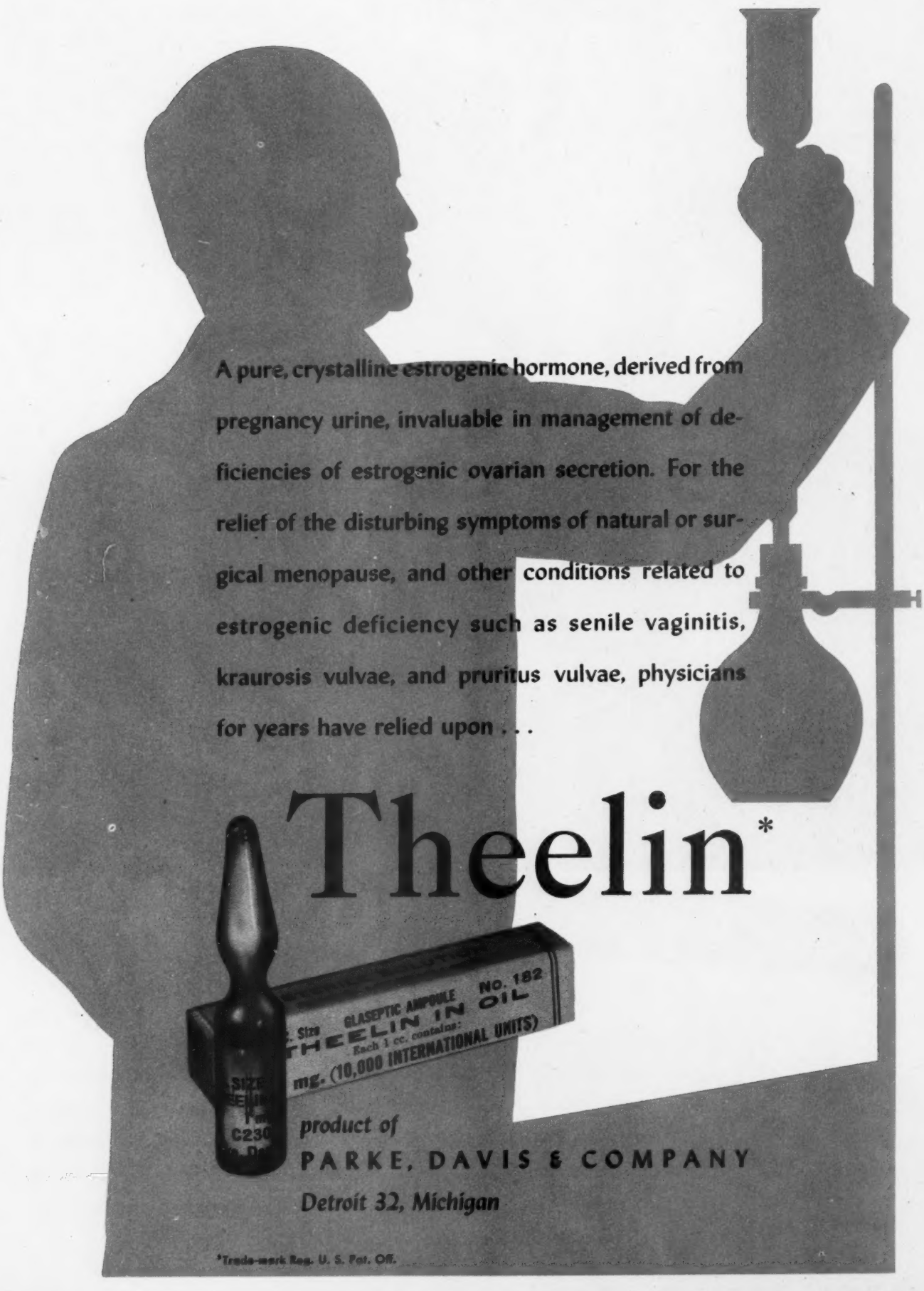
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*Meyer, E., and Arnold, L. (1938), *Amer. J. Digest. Dis.*, 5:418.

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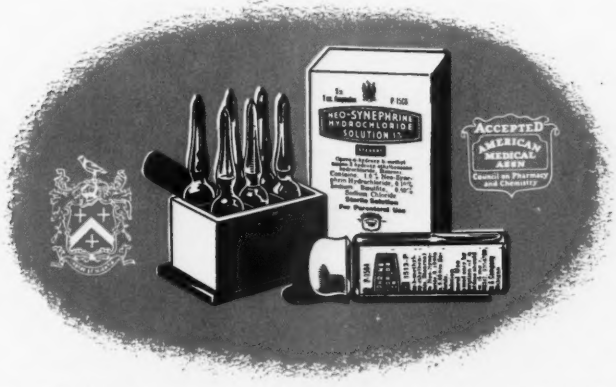

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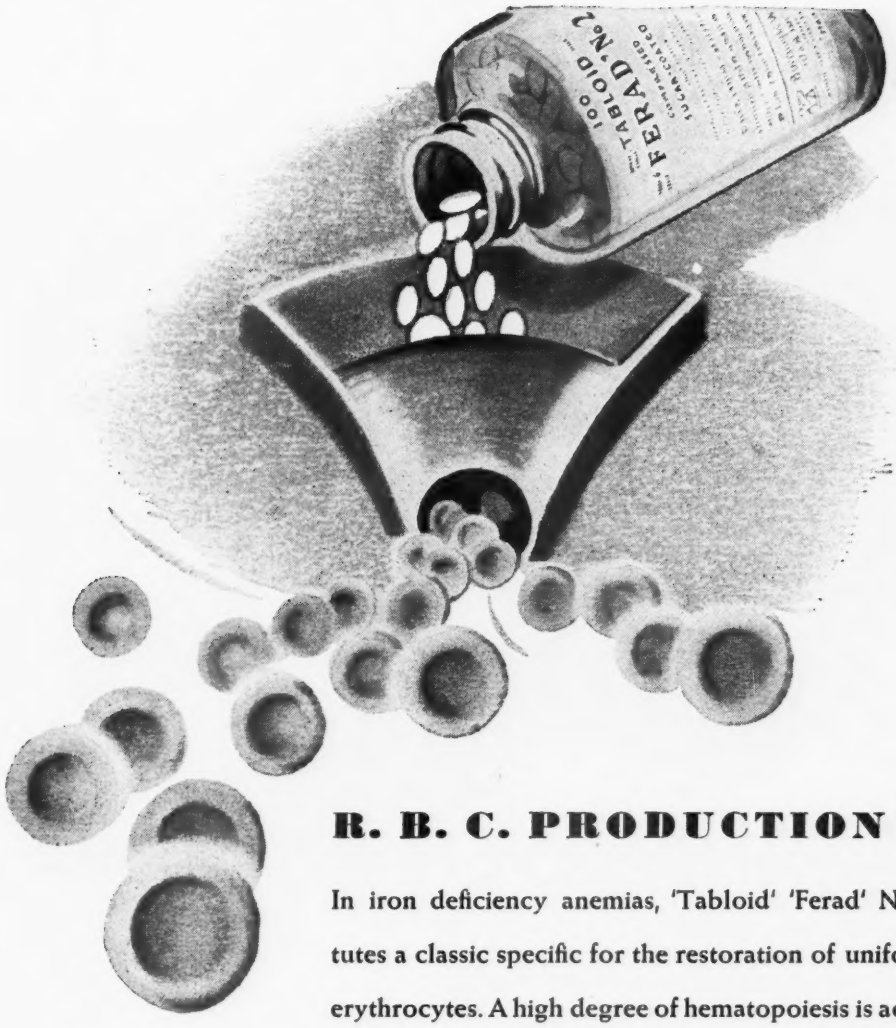

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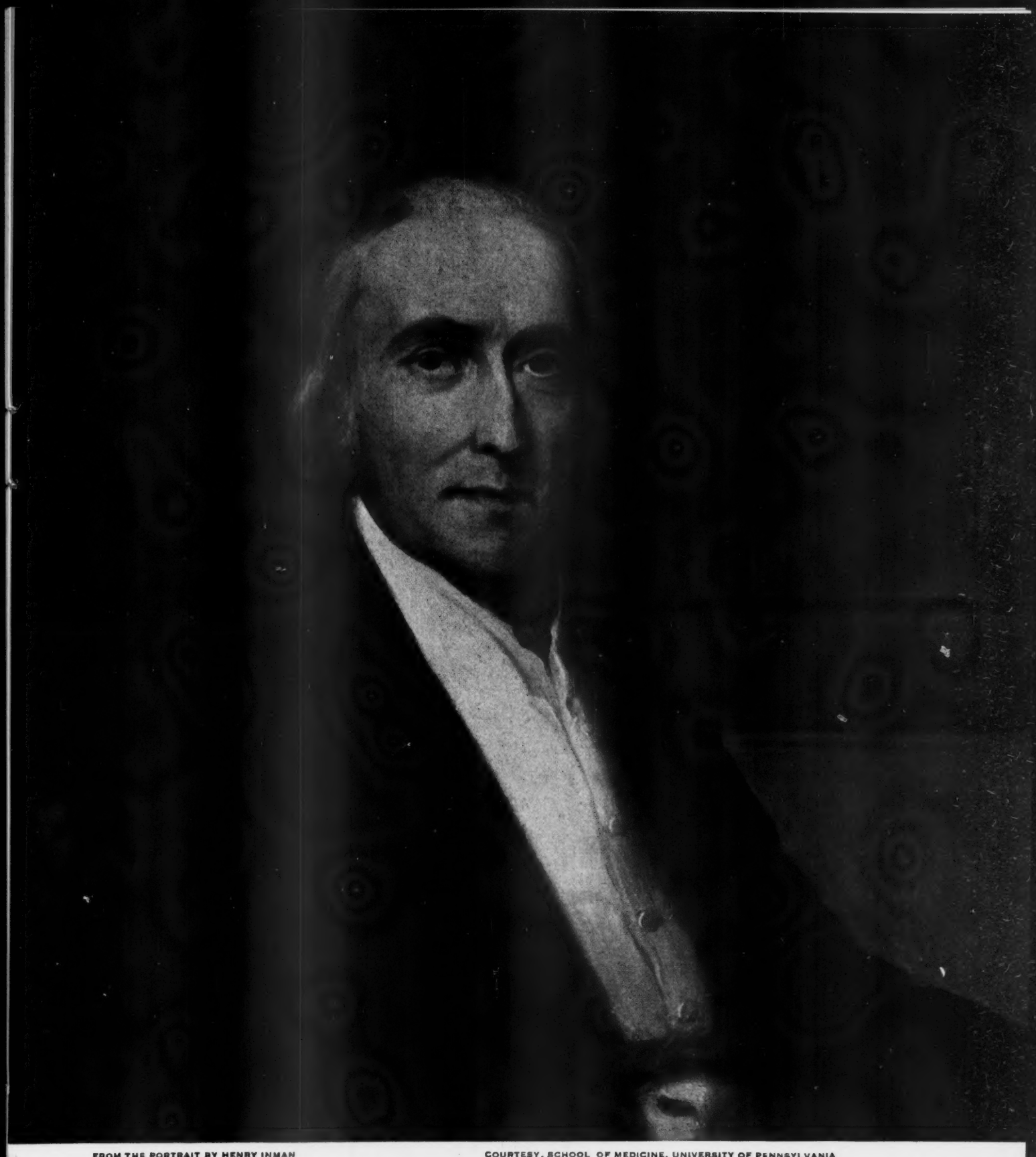

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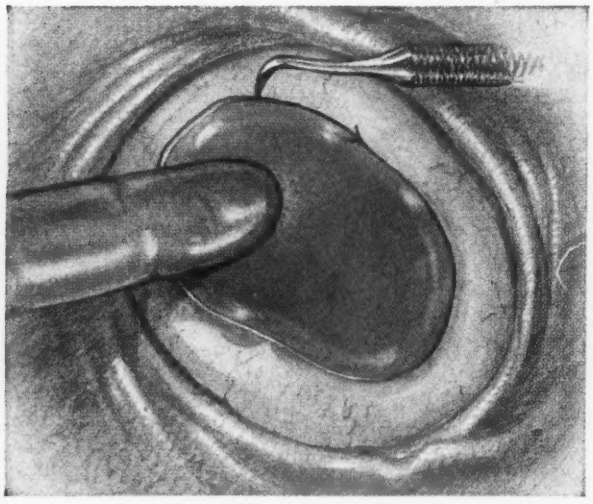
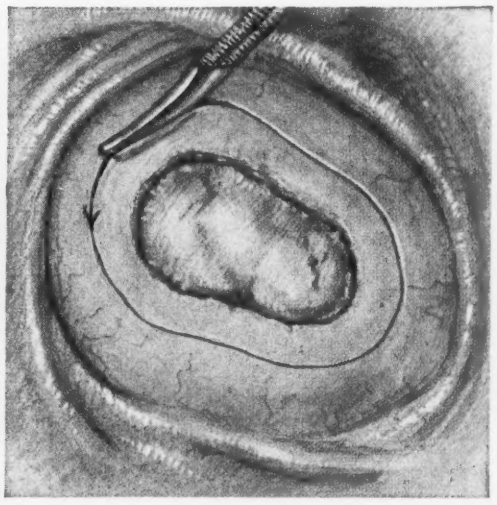
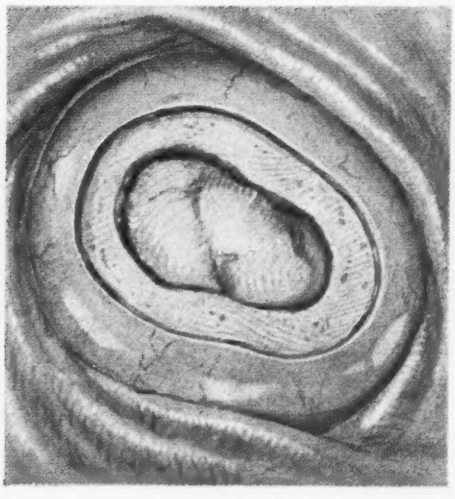


1. A tantalum plate of correct size and shape is placed over the defect and outlined by a scriber.

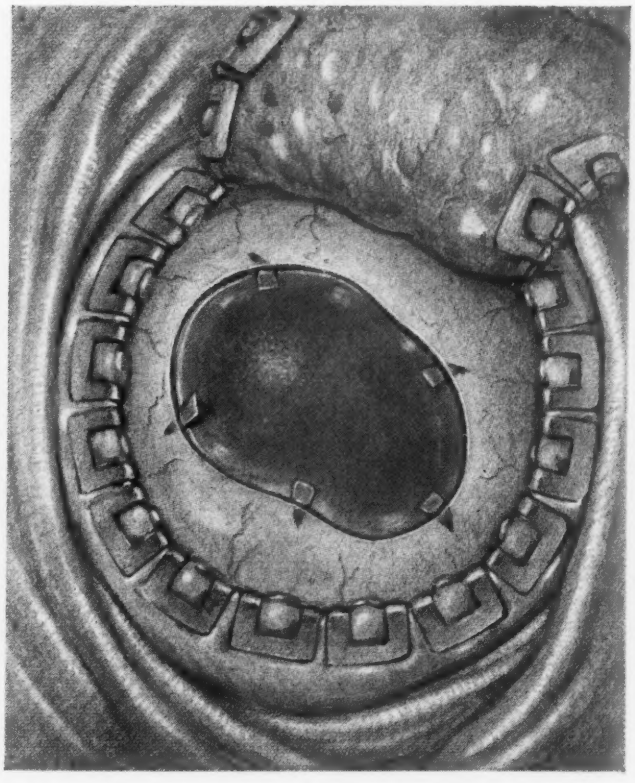


2. A lineator with cutting edge cuts the outer skull table, following the plate outline.

Skull Repair



3. A shelf is formed by chiseling away a thin layer of outer skull table from edge of defect to groove cut by lineator.



4. Tantalum plate set on bone shelf and secured by triangular tantalum points. Point holes are made by a flat triangular gouge and points pressed downward.

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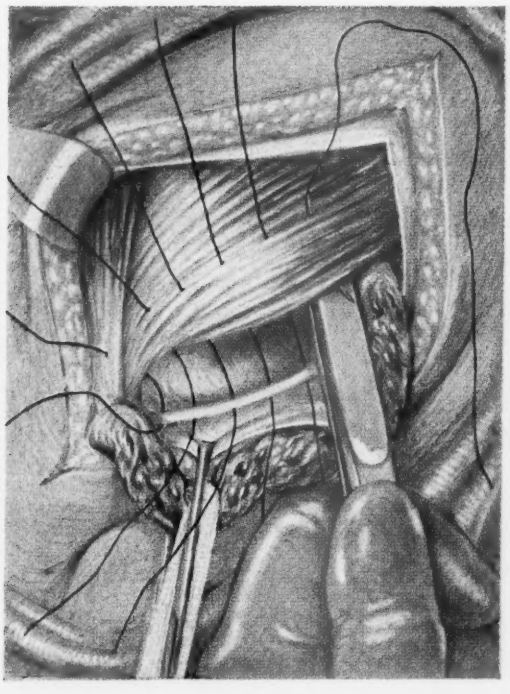

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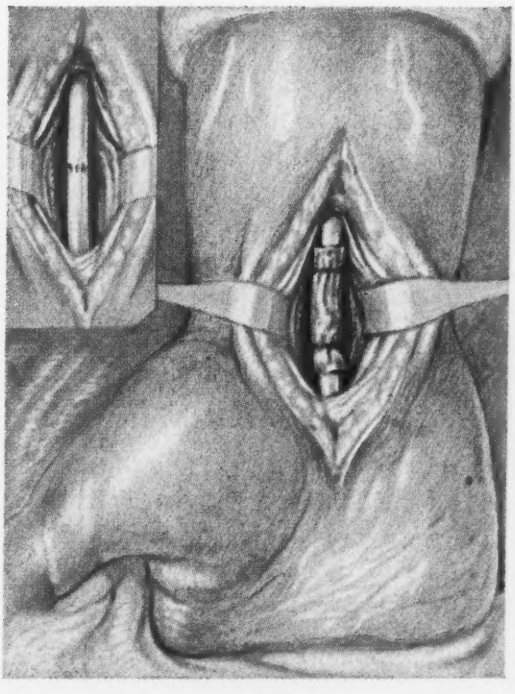
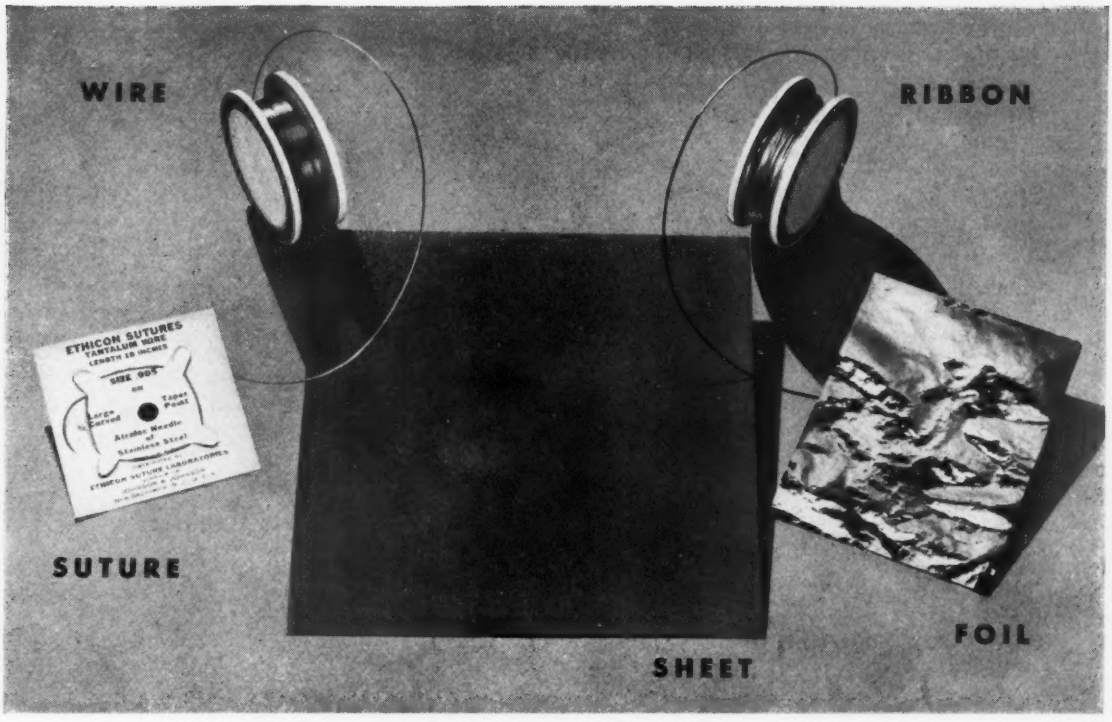


Nerve Repair

(Inset) Fine gauge tantalum sutures approximate epineurium of severed median nerve . . . Tantalum foil wrapped loosely about repaired section and secured by loose ties.



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NEW SERIES VOL. LXV SEPTEMBER, 1944 NUMBER THREE

Editorial

DIAGNOSTIC CURETTAGE*

BECAUSE of the present tendency, in some quarters, to advocate vaginal hysterectomy in all cases of indefinite uterine bleeding, regardless of diagnostic curettage, and as April is the cancer month in the United States, it seems to me the consideration of the subject is very timely; moreover it is of general interest.

In 1914, I read a paper before the Obstetric Section of the New York Academy of Medicine entitled "Complete Removal of Adenocarcinoma of the Uterus by Exploratory Curettage" and described three personal cases. The fact that early adenocarcinoma can be removed completely by curettage is of no extraordinary significance; but because the cases were the first to be recorded in all of the American and British literature, I was prompted out of a pioneering spirit and professional vanity to report them. However, eighteen cases were reported in Germany and Austria between the years 1888 and 1913. After the publication of my paper in 1915, similar cases were recorded in the United States and in nearly all civilized countries.

These cases were not offered by me as examples of cure of corporeal carcinoma by curettage, as was misinterpreted by some writers. On the contrary, immediate total extirpation of the uterus was definitely urged in all cases in which microscopy of the curettings showed malignancy, including the cases in which a second curettage was done for some reason or other and showed that the lesion had been entirely removed by the first curettage.

However, while I was preparing the paper it occurred to me that it would be a great boon to womankind if carcinoma of the body of the uterus could be detected in its incipiency, and that in diagnostic curettage we had the readily available means of doing it. The paper was accordingly devoted to an earnest and urgent appeal for the general adoption of diagnostic curettage as a routine measure in all cases of doubtful uterine bleeding; and this applies especially to women approaching the menopause and to those beyond it.

Here I would like to sound a word of warning: It must not be taken for granted that the uterine bleeding in menopausal cases is due to the administration of estogens without confirmation by a diagnostic curettage.

I confess that this appeal did meet with some opposition then. Among some of the objections was the possibility of stirring up something by the curette. This is not in accord with my experience. I have never met any untoward effect from an intelligent use of the curette, and it has been my

* Read at a meeting of The Clinical Society of the New York Polyclinic Medical School and Hospital, May 1, 1944.

practice for many years to perform a preliminary curettage to all hysterectomies in which there is the slightest doubt as to the benign condition. If the curettings appear negative on gross inspection, a supravaginal hysterectomy is performed immediately; but if the gross inspection of them is positive or on the border line, the indicated total hysterectomy is postponed until the diagnosis is confirmed by the microscope. There is a twofold reason for this procedure: First to determine in advance between the choice of supravaginal and total hysterectomy, because the difference between them in my opinion is that between a minor and major operation; and the other reason is to avoid a most disagreeable surprise and embarrassment both to the surgeon and relatives on discovering malignancy in the uterus after it had been extirpated.

Another and most conclusive answer to the above objection can be found in the fact that in some of the cases reported here and abroad, the uterus was not extirpated because a second curettage showed the lesion had been completely removed by the first curettage and the patients remained well for some time.

"A Plea for Early Diagnostic Curettage and Routine Microscopy of Curettings for the Detection of Adenocarcinoma of the Uterus" was the title of a paper I read at a symposium on cancer before the New York County Medical Society in 1927. This paper was published in February 1928, and, I believe, met with general favor. This belief was strengthened when The American Health Association invited me to give a talk on "What Women Should Know About Cancer," over Radio Station WJZ, June 5, 1929, and I dwelt particularly on the advantages and benefits of a diagnostic curettage.

Diagnostic curettage still is and will remain the most reliable and effective means available of detecting adenocarcinoma, especially in its earliest stages and, in my opinion, will never be replaced by the hit or miss, mostly miss, expedient of a prophylactic vaginal hysterectomy, which in many instances, will add to the list of operations unnecessarily performed.

Curettage for diagnostic purposes is of no value unless it is performed with particular care and special attention is given to the shape of the uterine cavity. The uterine cavity is not tubular but triangular, flattened before backward, with its walls closely approximated and joined at sharp angles on either side. At each superior angle is a funnel-shaped cavity at the bottom of which is the orifice of the Fallopian tubes, and unless the curette covers the entire surface of the cavity in a systematic and thorough manner, an early lesion may be overlooked. However, as the curettage is done primarily for diagnostic purposes and not as a curative measure, it should be discontinued in the later stages of the disease, as soon as sufficient material is procured for microscopic examination.

It is needless to say that the microscopy must be done by competent pathologists. While frozen sections may be relied on in tests for cancer in other parts of the body, it must never be used in the examination of uterine curettings; and here I desire to stress the fact that only paraffin sections of all material removed by the currette should invariably be used for microscopic examination.

I will cite a case showing the importance and value of the procedure and also of the above precautions: Some time ago a doctor referred a patient to me whose history and findings were suspicious of malignancy. I advised a diagnostic curettage which I performed at the Polyclinic Hospital. The doctor, because of his anxiety to learn the result had a frozen section examined against my advice, which proved to be negative and he so informed the patient. She thereupon decided to leave the hospital. With some difficulty I persuaded her to stay until paraffin sections could be examined which proved positive for adenocarcinoma. I performed a total hysterectomy and she has been well since.

The laboratory report follows: "The microscopic examination of the curettings showed adenocarcinoma of the uterus, which is probably not invasive, and should the uterus be removed may be found for the most part to have been curetted away. On gross inspection there is found a small cellular area in one corner of the uterus which is apparently a focus of adenocarcinoma. This on microscopic examination showed adenocarcinomatous growth corresponding to that found in the curettings removed previously." The slides were sent to Dr. Ewing for confirmation and I quote from his report: "In the section of uterus of X I do not find any tendency to infiltration of the muscularis by the adenocarcinoma and on that account I do not think postoperative *x*-ray treatment is indicated."

This case, one of a number of similar cases, is especially interesting as an illuminating example of the great value of diagnostic curettage and the importance of the precepts stressed above. If this patient had left the hospital without submitting to a hysterectomy and would have decided on another curettage by another surgeon or even by me before undergoing operation, in all probability, because of the location of the lesion, no trace of malignancy would have been found in the second curettage, and the proper treatment might not have been instituted. This actually happened in one of the three cases I reported in my first paper.

There is no room in this country for an advanced case of adenocarcinoma of the body of the uterus. Every such case records an instance of neglect on the part of the patient, a wrong diagnosis or a diagnosis made too late, and presents an example of a woman suffering from cancer who has been denied the benefits and the advantages of early diagnosis and the hope of cure that early treatment affords. I very much regret to say there is still room for the necessity of reminding the public and the profession that diagnostic curettage is absolutely and positively a life saving procedure.

Louis J. Ladin, M.D.

Original Articles

TUMORS OF THE UROGENITAL TRACT IN THE YOUNG*

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MALIGNANT neoplastic disease is so often associated with the older age group of patients that at times the fact that such disease not infrequently exists in infants and children is overlooked, and its importance is disregarded. The successful therapy of all malignancies depends upon early recognition; and because this early diagnosis is so imperative, it is the purpose of this presentation to recapitulate the more usual types of neoplasms of the genitourinary tract which are encountered in children, and to focus the attention of the physician on the possibility of the existence of neoplastic disease in the young. Despite a comparatively low incidence of such disease, these tumors grow so rapidly, produce so few prominent symptoms until very far advanced, and result in such a high mortality, that the problem of these lesions becomes one of very grave import.

Cases of neoplasms arising in the urogenital tract of children admitted to the New York Post-Graduate Hospital during the past two decades have been analyzed. This is a general hospital caring for cases of acute disease, with no particularly special emphasis on malignant disease or pediatrics; consequently it is believed that the cases observed are representative of those which may be found in the usual active general hospital anywhere and a discussion of these cases may bring to the fore the likelihood of the existence of these tumors in children and stress the need for early recognition.

TABLE 1

CASES OF MALIGNANT TUMORS IN CHILDREN

Renal tumors		32
Adenomyosarcoma (Wilms tumors)	31	
Papillary carcinoma of kidney	1	
Tumors of the adrenal		3
Tumors of bladder		4
Tumors of testis (teratomas)		4
		43

NEOPLASMS OF THE KIDNEY

These are the most common neoplasms of the urinary tract and of the abdomen in the young, and comprise about one-fifth of all tumors in children, second in frequency only to those of the eye. Moreover, almost all of these renal tumors are of the Wilms type. Of the thirty-two malignant neoplasms of the kidney observed, thirty-one were Wilms tumors; one tumor diagnosed preoperatively as a Wilms tumor in a boy six and one-half years of age, was found, on pathological examination, to be a papillary carcinoma of the kidney. Although hypernephromas and adenocarcinomas of the kidney in children have been described, they are exceedingly rare, and we have not observed any of these lesions.

Pathology of Wilms Tumor. (Figs. 1 and 2.) In 1899, Wilms defined the tumor which now bears his name. It has variously been designated as congenital mixed tumor, leiomyosarcoma, rhabdosarcoma, and tera-

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toma, but at present the more descriptive term of embryonal adenomyosarcoma is generally accepted. The origin of this type of tumor has not been definitely settled, but because of the varied histological features present, i.e., several component tissues, and the several degrees of differentiation of the component cells, the tumors must be considered embryonal, arising in the course of the fetal development of the kidney. Several theories have been advanced to explain the formation of the tumor: (1) Persistence of Wolffian body tissue among the cells of the developing kidney; the tumor would have its origin in this remnant of the Wolffian body. (2) Aberrant cells of the myotome and sclerotome within the nephrotome serve as a point of origin of the tumor; the mixed character of the tumor would be explained by these different formative constituents. (3) Embryonal tissue of true kidney persists, later becoming metamorphosed into varied cellular structures. This theory denies the origin of the tumor from inclusions of extrarenal bodies, which the other two theories proclaim, and is favored by Ewing.[7]

The tumor may be of varying proportion, but the majority are large and give rise to clinical recognition by their size. Characteristically, the tumor grows rapidly and may become enormous. It is generally solid, grayish-white in color and encapsulated in a layer of tough connective tissue which separates it from the kidney proper, but the renal capsule is found to blend with this encapsulating tumor layer. Hemorrhagic or softened areas are not uncommon, and the lower pole of the kidney is the most frequent site of tumor origin. Since the tumor grows by expansion rather than infiltration, the kidney itself and the pelvis are found to be compressed and distorted. This tendency to expand, rather than to infiltrate, and the characteristic encapsulation are probably the reason for the paucity of urinary signs and symptoms. The pelvis is not invaded until the tumor ruptures through its capsule late in the course of development and, as a result, hematuria is not noted in a majority of the cases.

The tumor is generally unilateral, but cases of bilateral tumor have been reported. It displaces the colon by its growth and occasionally invades it, and, on the right side, may obstruct the duodenum. Neither side is, however, affected any more often than the other. Metastasis is by the blood stream and spread is found in the liver, lungs and brain. Approximately one-fourth of our cases had demonstrable metastases when first seen.

Age. In this series, sex was equally divided (fifteen girls, sixteen boys) and the average age of the patient was three and one-fourth years, the age range extending from the youngest child of five months to one girl of sixteen years. This age incidence is in agreement with reports in the literature, tumors arising in patients beyond the age of ten only in rare instances.

Symptoms. Wilms tumor has been called a disease of signs rather than symptoms. The presenting complaint in the vast majority of cases is that of a gradual enlargement of the abdomen, thus leading to the discovery of a tumor mass. Hematuria, though stated by Campbell[3] to be present in 15 per cent of the cases, has been found to be present in our series in only 3 per cent, which is in agreement with the findings of Dean.[5] This low incidence of hematuria is in distinct contrast to the frequency of hematuria in malignant tumors of the kidney in the adult. No doubt this is due to the fact that the hypernephroma of the adult is invasive and ulcerates through into the pelvis of the kidney, whence red blood cells thus enter the drainage system and are found in the urine. On the other hand, as has been stated, the Wilms tumor is enclosed within a capsule until late in the progress of the growth. When the size of the tumor becomes so large as to produce pressure, one may note nausea, vomiting, constipation, because of compression of

the abdominal viscera, and dyspnea due to the elevated diaphragm. Jaundice may supervene. Terminal stages show extreme cachexia, ascites and anemia. Pain does not occur early. Fever, the mechanism of which is obscure and which is also found in children who have other types of malignant neoplasms such as lymphosarcoma, is present in about one-half of the cases.

FIG. 1.

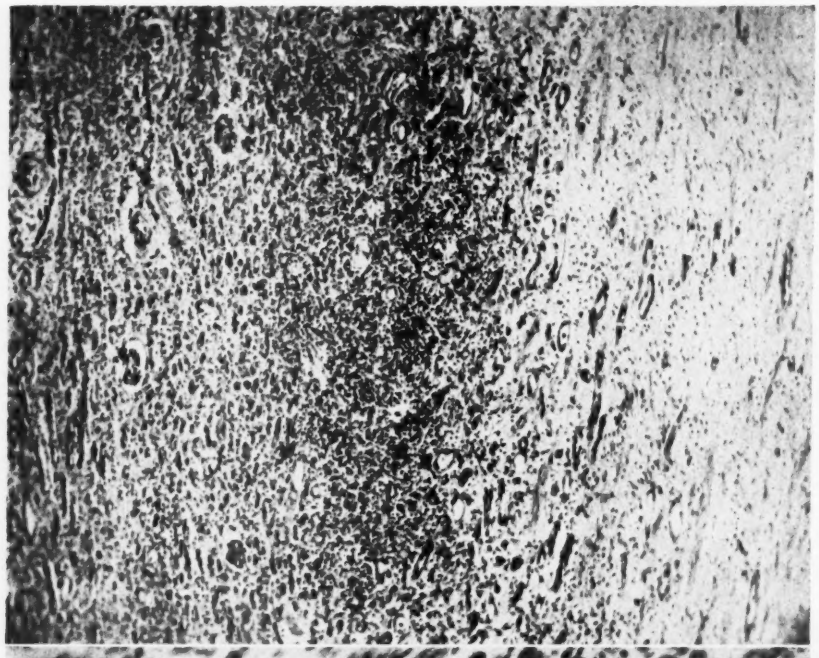

FIG. 2.

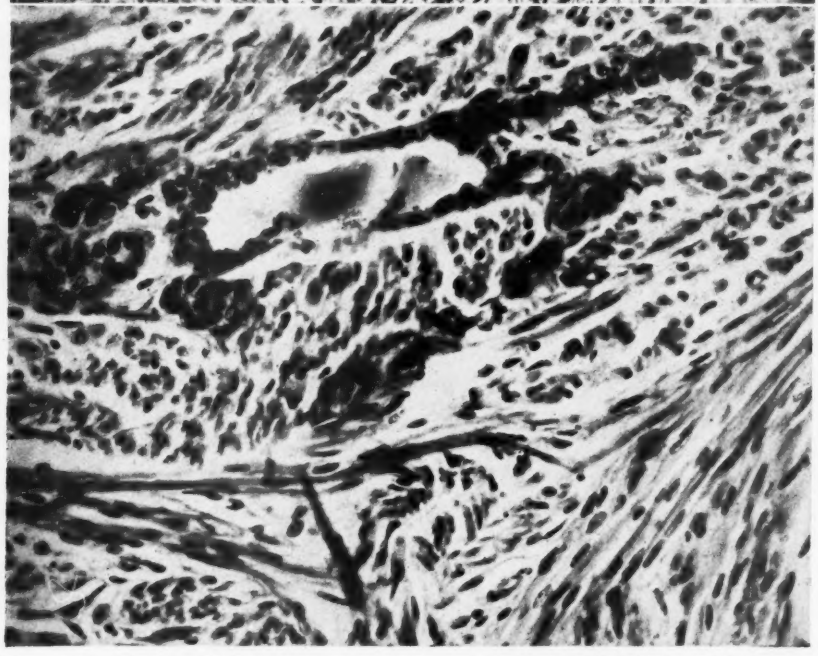

FIG. 1. Section of Wilms tumor. Low power view showing kidney tissue on the left, an intermediate zone of compressed tissue and inflammatory cells, and tumor on the right. × 167.

FIG. 2. High power magnification showing mixed elements of the Wilms tumor: kidney tubules, smooth muscle fibers and striated muscle fibers. × 635.

Diagnosis. The mass, found on palpation to be smooth in most instances, has a mobility depending on its size. It is fairly characteristic to find that the mass

has grown downward, forward and across the abdomen toward the opposite side rather than to bulge in the flank as is usual with adult kidney tumors. (Figs. 3 and 4.)

twenty-three days for a huge solitary cyst of the kidney which prior to operation had been suspected of being a Wilms

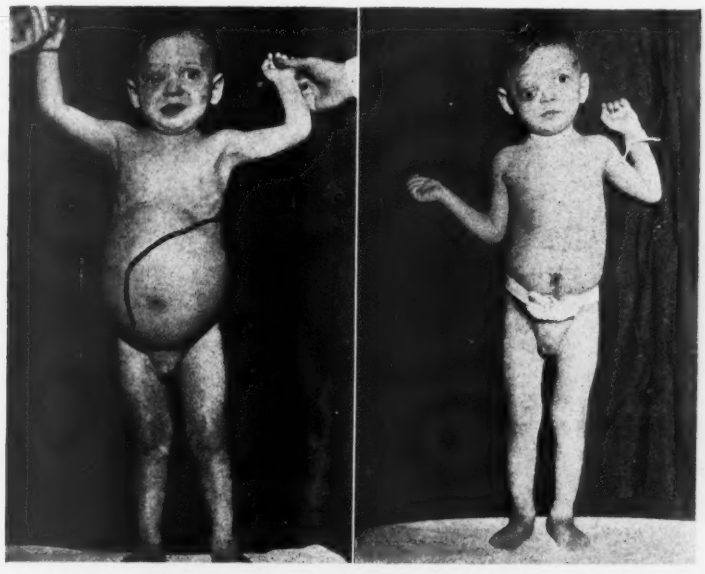

Fig. 3. Fig. 4.

Fig. 3. Two year old child with a large Wilms tumor. The pronounced abdominal enlargement due to tumor mass is readily seen. The extent of the mass is outlined on the abdominal skin.

Fig. 4. Same child after operation. The abdomen is now normal in size, but the proptosis of the eye, due to retrobulbar metastasis, is very evident. This child died approximately ten months after surgical removal of the mass.

Diagnosis can be made by intravenous urography which shows not only displacement of the affected kidney and distortion of the pelvis, but also delineates the opposite kidney and reveals whether it is functionally sound. Where intravenous urography does not suffice, retrograde pyelographic studies may be necessary and should not be delayed. Age is no contraindication to retrograde urography for the armamentarium of the present-day urologist enables him to examine completely any child, no matter how tender the age of the patient. (Figs. 4 and 5.)

Differential diagnosis includes the following: (1) Suprarenal tumors (these are discussed below); (2) cystic kidneys—solitary cyst or polycystic kidney must be considered in diagnosis of the abdominal mass. Our records include the case of an infant girl operated upon at the age of tumor. (3) Hydronephrosis produced by aberrant vessels or congenital strictures of the ureter or to bands obstructing the ureter may be differentiated by urographic studies. (4) Ovarian tumor and hepatic tumor may have to be excluded in the differential diagnosis, but these conditions are very rare in children. (5) Splenomegaly should be considered; blood studies will help in the differentiation of this condition. (5) Sarcoma of the retroperitoneal or mesenteric nodes—these masses generally are irregular and nodular, and involvement of other lymph nodes will aid in the diagnostic exclusion of these diseases.

Aspiration biopsy has been advocated by some, but this is mentioned here only to be condemned. Similarly, exploratory operation for diagnosis appears to us to be unnecessary as the diagnosis should be made *preoperatively* by urologic procedures.

Treatment. This should be a combination of *x*-ray therapy and surgery. Pre-

operative radiation serves in many cases to reduce the mass in size and to increase its mobility. Although the details of the roentgen treatment should be determined by the *x*-ray therapist, one must stress the importance of radiation through several portals in fractionated doses rather than by means of a single massive dose, with the protection of vital organs, especially the liver and spleen. However, though these precautions may be taken, diarrhea, nausea, vomiting and anemia generally supervene. Vitamin B complex aids in reducing the intensity of the gastrointestinal symptoms and it also may be found necessary to give multiple transfusions to overcome both the anemia and the leukopenia which may be the result of *x*-ray treatment.

Fig. 5. Urogram reveals a homogenous mass density on the left and upward displacement of the left kidney. There is delineation of a normal right kidney.

Fig. 6. Close-up of the area of the left upward displaced kidney in the same patient as in Figure 5. The arrow points to the distorted renal pelvis as outlined by the intravenously administered urographic dye.

Approximately five to six weeks following the termination of radiation treatment is probably the optimum time for surgical removal of the mass. We definitely favor the transperitoneal approach, exposure of the mass is simpler, and the renal vascular pedicle can be clamped off early in the procedure before complete mobilization of the mass. This tends to obviate or preclude the dissemination of tumor thrombi which may be in the renal veins, and which might be torn loose while manipulating the tumor during its mobilization, if the iliocostal approach is employed. Liberal transfusion is indicated. Postoperative radiation should also be given about one month after the nephrectomy. Where metastasis is present or found at a later date, intensive radiation should also be given to the involved sites.

Although surgical success is rare, removal of the mass should be urged in every case. We cannot agree with the statement of one author who advised that "All Wilms tumors are best treated with radiation alone."[5] Nephrectomy appears to be essential, for irradiation *per se* cannot be depended upon to destroy all of the malignant cells.

Results. These are uniformly recognized to be poor. The average life expectancy following initial discovery of the tumor is said to be about eight months.[3] Analysis of our thirty-one cases are shown in Table II.

Though long survivals postoperatively have been reported,[13,17] the figure of ultimate mortality is about 90 to 95 per cent. This poor outlook can be changed

only by early recognition of the disease. Even then one must point out the high immediate postoperative mortality, which has not changed too significantly even with our many advances in surgery. Walker,[19] in 1897, reporting the immediate mortality in a series of 120 cases of Wilms tumor, stated that the percentage was 38.2 per cent, while in our own series this figure is 25.8 per cent. Despite this rather depressing aspect, one must, nevertheless, make every attempt to diagnose the lesion early and to institute treatment as soon as possible, for the only hope of survival lies in securing these cases before metastasis has occurred.

Table II

1. Metastases present on admission: 8 cases—25 per cent
2. Immediate postoperative mortality: 8 cases—25 per cent
3. Known good results:
   1 child alive 3 years after operation
   1 child alive 2 months after operation
4. Mortality subsequent to surgery:
   2 died ½ year after operation
   2 died 1 year after operation
   1 died 2½ years after operation
   1 died 3 years after operation
5. No follow up: 7 cases.

TUMORS OF THE ADRENAL

Since the adrenal gland is related anatomically, surgically, and endocrinologically to the urogenital tract, it must be considered in the problem of malignant neoplasms of that system. The adrenal ranks second in frequency in giving rise to tumors of the abdomen in children. Embryologically, the adrenal is derived from two germ layers: the mesoblast gives rise to the cortex, and the ectoderm (the sympathetic nervous system) to the medulla. Most of the tumors of children which are called "retroperitoneal sarcomas" are actually neuroblastomas and are derived from the adrenal medulla. It should also be pointed out that malignant tumors of the medulla are almost exclusively found in childhood. (Cortical tumors which are very unusual and always produce sexual developmental changes, are not considered here.) These neuroblastomas (neurocytomas) arise in early life; we have seen three cases, two aged one and one-half years and one three and one-half years old. The mass grows rapidly, protrudes posteriorly in the flank, and may have to be differentiated from renal tumor. Urograms show a downward displacement of the kidney, with less distortion of the pelvis than is seen with the Wilms tumor; however, frequently exact differentiation is extremely difficult and the true character of the disease may be discovered only at the time of surgical intervention. Unfortunately, in most instances metastases are already present when the abdominal tumor first becomes apparent. In other cases, the metastases produce the presenting symptom and the underlying nature of the disease is found only at autopsy. Usually, if surgery is performed, the exact diagnosis becomes apparent only at that time; most of the cases are inoperable, metastases and invasion having occurred early. In our three cases, metastases were already widespread at the time the children were first seen. These metastatic lesions take two forms and they give rise, therefore, to two clinically distinguishable types: extensive metastases to the liver producing marked abdominal enlargement with pain, nausea, vomiting and cachexia (Pepper type); the second or Hutchinson type of metastasis is characterized by early orbital and skeletal masses with consequent swelling of bones about the skull, proptosis of the eye and profound anemia. In either type, the course is rapidly fatal and death occurs within a few months.

Pathologically, the neuroblastomas show embryonal nerve cells and fibers, the former frequently are arranged in round clusters called rosettes. The metastases are similar to the primary growth.

Unfortunately, treatment in these cases is hampered by the fact that spread has so frequently occurred before medical aid is sought. Where metastasis is present, surgery is contraindicated and resort may be had to radiation therapy. In the infre-

quent case in which primary operability is present, it may be possible to shell out the tumor *in toto* or else extensive dissection may be required. The outlook, however, is extremely poor, and of the cases reported in the literature, the mortality is almost 100 per cent.

TUMORS OF THE URETER

Primary tumors of the ureter in children are practically non-existent; we have not seen any such cases. Occasionally, an ureteral tumor secondary to a primary renal growth may be found.

TUMORS OF THE BLADDER

Vesical tumors are quite unusual in children; of four cases observed here, two were sarcomas, one showed a small papilloma of the bladder while the fourth had multiple papillomas. The inclusion of the latter two cases is done because, though microscopic examination may show them to be benign, all are *potentially malignant* if only in their tendency to local recurrence.

The vast majority of bladder tumors in children, however, are sarcomatous and are generally very far advanced when first brought to the physician's attention. Symptoms result from vesical irritation and urinary obstruction, producing frequency, dysuria, urgency, straining on voiding and incontinence. With subsequent ulceration of the tumor, pyuria and hematuria are noted. When diagnosis is made, unfortunately the tumor is widespread in the bladder and the general condition of the patient is too poor to permit radical surgery; consequently one must resort to the palliative measure of suprapubic drainage. Benign tumors respond to cystoscopic electrofulgeration or resection. In the event of early discovery of a vesical sarcoma, bilateral transplantation of the ureters to the bowel followed by cystectomy might be employed. Though *x*-ray radiation has been used in cases of these malignant tumors, such treatment is apparently of little benefit.

TUMORS OF THE PROSTATE

These are quite rare and are similar in nature to the tumors of the bladder; they are predominately mesodermal in origin and are sarcomatous; often the true origin of the tumor (i.e., prostate or bladder) cannot be accurately determined because of widespread local extension at the time the case is brought to the physician's attention. Symptoms are due, as in vesical tumor, to obstruction of the urinary outlet, and only palliative therapy can be employed. Benign tumors of the prostate are exceptionally rare, but one such was encountered in a boy of fifteen who had a pedunculated tumor of the left lobe of the prostate. The tumor protruded into the posterior urethra and was easily removed by the transurethral route.

TUMORS OF URETHRA AND PENIS

Primary malignancies of the urethra practically never occur in children. However, papillomas are not infrequent in boys nor is urethral caruncle in girls very unusual. Urethral irritation generally produces enuresis and all such children should be examined to rule out the presence of these lesions. Electroresection will cure the papillomas of the deep urethra, but for the caruncles, complete excision is advised. We have had two patients who were completely relieved of urinary symptoms of removal of these growths.

Though we have several instances of cysts of the prepuce and meatus in boys, these are not truly new growths. Carcinoma of the penis does not occur in boys; but where the prepuce is tight and irritation results, the glans and prepuce may be the site of precancerous changes in early childhood. The child can of course be protected from such an eventuality by circumcision shortly after birth.

TUMORS OF THE SPERMATIC CORD

Malignant growths of the spermatic cord are exceptionally rare; we have seen

none, but our cases include a number of lipomas and fibrolipomas of the cord, which were coincidental findings at operation for inguinal hernia.

TESTICULAR TUMORS

It is well known that malignant growths of the testis generally arise in the younger adult, but it must not be forgotten that such neoplasms are also seen on occasion in infancy and childhood. Two cases of tumor of the testicle have been seen at our hospital occurring in boys aged one year and eight months, and twelve and one half years, respectively; both were diagnosed on pathologic examination as teratomas. Seminoma is practically unknown in the young.

Any intrascrotal growth or testicular enlargement in boys should be looked upon as a malignant growth until definitely proved not to be so. Such a viewpoint must be held because very few ailments produce enlargement of the testicle in children, and because metastasis from a truly malignant growth of the testis occurs so early; hence dissemination is so wide that procrastination and delay in diagnosis utterly destroys the relatively few chances of therapeutic success. The tumor is congenital in origin, and Ewing's theory[7] is that the growth arises from totipotent sex cells, where there is predominance of a single tissue or structure; such an occurrence probably results from unilateral development of the potentially tridermal cells. Most of the tumors consist of anaplastic embryonal cells, but adult structures with advanced cellular differentiation frequently occur. Metastasis is at first by lymphatic extension to the abdominal nodes where these enlarged nodes can at times be palpated; later, hematogenous spread occurs as well and the lungs are frequent sites of metastatic implants.

Diagnosis should be made by palpation of a hard enlarged scrotal organ. A palpable abdominal mass representing metastatic growth should be sought and also *x*-ray examination of the chest should be made to eliminate pulmonary involvement. Aspiration of the testicular growth for purposes of biopsy is not recommended. An important diagnostic aid is the Aschheim–Zondek test as these tumors generally cause an increase in the urinary output of the follicle-stimulating hormone of the anterior pituitary body. When the tumor is removed, the test becomes negative only to become positive again should recurrence be present. This test then is valuable both in the diagnosis of the disease and the subsequent follow-up of the patient.

Treatment of the patients before spread has occurred should include *x*-ray radiation therapy, given preoperatively followed by orchiectomy. It is not believed that the radical operation with extensive dissection and removal of the inguinal and abdominal retroperitoneal nodes offers much more likelihood of greater success than does the orchiectomy for the reason that it is highly uncertain that all of the tumor cells can be removed where metastasis has occurred. In those cases in which lymphatic or hematogenous spread is present, only radiation therapy to the primary mass as well as to the secondary implants is advised.

CONCLUSIONS

1. Though malignant disease is primarily a disease of the adult, its occurrence in the young should not be overlooked, for only in its early recognition lies the possibility of successful therapy.

2. The most frequent tumor of the urogenital tract in children is Wilms tumor of the kidney. Diagnosis can be made in most instances by urographic measures. Preoperative and postoperative *x*-ray therapy should be given. It is held that the transperitoneal approach for removal of the kidney should be employed.

3. Less frequent in occurrence are tumors of the adrenal gland, bladder, prostate and testis, but the possibility of their existence, even in the very young, must

be emphasized and thorough search made for signs of these highly malignant growths.

4. Early diagnosis of malignant disease of the genitourinary tract in children is a *sine qua non* of successful therapy. In all cases, resort in treatment should be to *x*-ray radiation *and* surgery combined; radiation therapy should not be employed alone except in those cases in which widespread metastases are present.

REFERENCES

1. Balfour, W. M. Embryonal adenosarcoma of the kidney. *Lancet*, 59: 211, 1939.
2. Beer and Hyman. Diseases of the Urinary Tract in Children. New York, 1929. Hoeber & Co.
3. Campbell, M. F. Pediatric Urology. New York, 1937. MacMillan Co.
4. Campbell, M. F. Primary malignant tumors of the urogenital tract in infants and children. *J. A. M. A.* 109: 1606, 1937.
5. Dean, A. L. Cancers of the genitourinary tract in children, *J. Pediat.*, 15: 340, 1939.
6. Deming, C. L. Congenital sarcoma of the kidney in a child of 29 days. *J. A. M. A.*, 80: 902, 1923.
7. Ewing, J. Neoplastic Diseases. Philadelphia, 1941. W. B. Saunders Co.
8. Fraser, I. Sarcoma of the prostate in children. *Irish J. M. Sc.*, July, p. 330, 1939.
9. Higgins, C. C. and Shively, F. L., Jr. Malignant renal neoplasms in children. *Arch. Surg.*, 42: 386, 1941.
10. Hinman, F. and Kutzman, A. A. Malignant tumors of the kidney in children. *Ann. Surg.*, 80: 569, 1924.
11. Ingram, D. N. Wilms tumor. *Am. J. Surg.*, 32: 366, 1936.
12. Kretschmer, H. L. Malignant tumor of the kidney in children. *J. Urol.*, 39; 250, 1938.
13. Ladd, W. E. and White, R. H. Embryoma of the kidney. (Wilms tumor). *J. A. M. A.*, 117: 1858, 1941.
14. Lake, W. F. and Ayers, A. J. Renal and perirenal tumors in children. *South. M. J.*, 31: 992, 1938.
15. McNeill, W. H., Jr. and Chilko, A. J. Status of surgical and irradiation treatment of Wilms tumors. *J. Urol.*, 39: 297, 1938.
16. Mintz, H. O., Howell, R. D. and Hendricks, J. N. The limitations of irradiation of solid renal tumors in children. *J. Urol.*, 46: 1103, 1941.
17. Mixter, C. G. Malignant tumors of the kidney in infancy and childhood. *Ann. Surg.*, 96: 1017, 1932.
18. Rathbun, N. P. and Wehrbein, H. L. Lymphosarcoma of urinary bladder. *J. Urol.*, 51: 31, 1944.
19. Walker, G. Sarcoma of the kidney in children. *Ann. Surg.*, 26: 529, 1897.
20. Weisel, W., Dockerty, M. D. and Priestley, J. T. Wilms tumor of the kidney: a clinicopathologic study of forty-four proved cases. *J. Urol.*, 50: 399, 1943.
21. Wilms, M. Die Mischgeschwulste. Leipzig, 1899, Georgi.

HETEROGENOUS SKIN GRAFTS BY THE COAGULUM CONTACT METHOD

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I WAS impressed with the principle propounded, when I first read Dr. Sano's article in the *American Journal of Surgery*, July, 1943. She based her concept upon the same principles which were successful in growing cells outside of the body in tissue culture, and wondered whether it might not be applicable to skin grafting by providing, physiologically, adhesion of the graft to its bed through the use of plasma.

Dr. Sano quotes R. C. Parker: "In tissue culture, growth is obtained by supplying (1) a suitable surface for the cells to grow on through the use of coagulated plasma, (2) adequate nutrition through a medium composed of embryonic tissue extract and a buffered salt solution (Tyrodes). The most satisfactory cell growth is obtained in tissue culture by the use of homologus plasma and tissue extract. The plasma is heparanized when obtained, to prevent its coagulation until it comes in contact with the tissue extract and salt mixture at the time of planting the culture. With such contact, the fibrin is precipitated and a delicate clot is formed, which serves to fix the tiny fragment of tissue and thus permits cell growth to take place. In such cultures, it has been shown repeatedly that fibrin plastic proliferation normally begins within a matter of a few hours."

Dr. Sano also states in her article that in ten animal experiments, the results were entirely successful.

In view of these facts, I became very much enthused. However, not having access to animal experimentation, and knowing little or nothing about tissue culture and growth to hazard clinical investigation upon the basis of that report, the subject was actively dispelled from my mind until another of Dr. Sano's articles appeared in the November, 1943, issue of *Surgery, Gynecology and Obstetrics*. In this report she presented the clinical application of the coagulation method of skin grafting and described the technic used and end results in ten cases.

My previous mental enthusiasm was revied with its resultant manifestation in the clinical application of the method to several cases which subsequently presented themselves.

According to Dr. Sano's article, she was first stimulated to her investigation in the attempt to find some means of eliminating the arduous manner of skin grafting which she experienced while assisting a surgeon in that type of work. I was encouraged by her brilliant achievement and the logic of the procedure.

Fomon states; "Histologic changes of the application of a graft to the donor area is divided into three stages: (1) Stage of plasmic circulation. (2) Stage of vascularization. (3) Stage of organic union." As Fomon so aptly describes it: "Within a few minutes after transplantation, the blood vessels dilate, the dilation being followed by an exudation of plasma. The plasma soon becomes converted into fibrin, which not only serves to anchor the graft to its bed, but also forms a matrix for the plasma and lymph circulation, and a scaffolding for the budding of the endothelial cells of the blood vessels destined to nourish the graft."

The coagulation contact method merely replaced the stages through which the tissues must pass through the normal response in order to arrive at the same goal.

This saves a period of twenty-four to forty-eight hours, so that the graft has an advanced start of fixing itself to the recipient area.

Fig. 1. Case vii. Shows a heterogenous graft on the thigh. This graft is in the third week. The graft was taken with the dermatome and measures about thirty-two square inches. The thickness was .014 of an inch. The graft is placed in the center of a granulating area. Dressings were applied to the granulation tissue around the graft only. In this instance the graft only was heterogenous, the plasma and cell extract being taken from the patient.

Heretofore, when a graft was applied, a series of the usual type of interrupted or continuous sutures were inserted to keep the graft in place and to approximate its margins. Next the problem of pressure was to be considered. This was also a source of worry because the amount of pressure to apply was at the best a matter of guesswork.

F. Smith has estimated the ideal pressure for full thickness grafts to be 30 mm. to the square inch. Various ingenious methods have been advocated to maintain this pressure, but in the final analysis, no standard method is available. Every surgeon develops a technic augmented by his experience and surgical judgment.

Balloons, various types of sea sponges, marine sponges, rubber sponges, mechanics waste and many layers of gauze elastic and compression bandages have been and are being used to produce that certain amount of pressure on the graft. Then stay sutures were inserted to fix these various materials in place and to immobilize the graft.

An insufficient amount of pressure permitted the accumulation of serum and sometimes blood with the resultant loss of the graft or the predisposition to infection. Too much pressure prevented the normal amount of exudation of plasma and the subsequent budding of the capillaries into the graft.

The sutures which were inserted were conducive to bleeding, subject to infection, and if permitted to stay too long, produced stitch marks which resulted in a poor cosmetic result. The stay sutures pulled, thus producing pain, and were also subject to infection.

By the use of the coagulum contact method, these hazards are eliminated. In addition, shock, which in its own right is a very potent factor to be considered, is lessened by shortening the duration of the operative procedure and by lessening the quantity of anesthetic used.

The cases reported by Dr. Sano were representative. The results generally speaking were excellent. All the cases reported

were done with autogenous grafts and homologus plasma and cell extract.

I tried several cases, using the same technic and the results were so satisfactory, that I decided to vary the type of graft. When the heterogenous iso graft with autogenous plasma and cell extract was used the result was excellent. A heterogenous iso-graft with homologus plasma and cell extract also gave an excellent result. Following the successful takes with these grafts, I was curious to see whether a heterogenous iso-graft with a stock plasma and cell extract would likewise be successful. This was done also with excellent results. These procedures were carried out on actual cases which represented the types of conditions in which such grafts should be used.

Fig. 2. Case VIII. Heterogenous graft from the father of the child. In this case the plasma and cell extract were also taken from the father. Graft is two weeks old and shows a good take over the buttocks and pelvis. The total amount of skin was approximately sixty-four square inches. One of the grafts was split to surround some scar tissue. The graft was .016 of an inch in thickness. The surrounding area shows infected granulations.

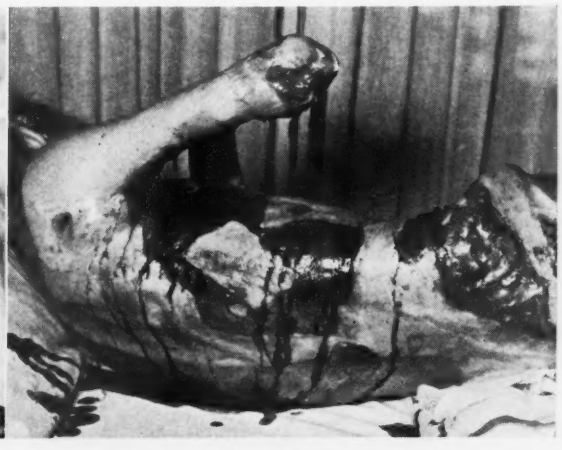

Fig. 3. Case IX. Heterogenous graft to chest wall of three weeks' duration. This graft is placed more toward the posterolateral side. In this instance, a non-member of the family was used for the skin and an entirely different blood was used to make the plasma and cell extract. A good take. Only about twenty-four square inches of skin were used because of the uncertainty of the final results. There is a slight wrinkling in the lower most angle. This is due to the weight of the first sulfathiazole dressing which pulled the graft against the dressing. Subsequent dressings were not applied to the graft. Only the surrounding granulating tissues were dressed. Even with thickly applied ointment dressings, there was bleeding when the dressings were changed as can be noted.

The heterogenous iso-graft with the patient's own plasma and cell extract was first used on a twelve-year old girl, who had been burned completely on one side of the body, including the entire upper and lower extremity on the right side. The child was neglected for about four months before any kind of treatment was instigated. Various types of burn treatments were given with no visible results. The child was emaciated, had a blood dyscrasia and septic hyperpyrexia. Profuse bleeding occurred from the burned area even when redressings were not done. The granulation tissue was infected.

The girl was not in physical condition for grafting. She had no skin to give. A heterogenous graft was considered, but there was a question whether she could stand shock associated with that. The father of the girl was consulted and fully advised about Dr. Sano's procedure and the possibility of failure was explained, and that even with a good take it was only a palliative measure. He consented to the procedure and volunteered to be the donor. The results of the grafting were excellent; the take was perfect. The little girl responded well and appeared to fare better. Only one drum of skin was used, about 10 cm. by 15 cm. The only objectionable feature was the fact that we had to take blood from the patient and this she resented, because of the pain and I was hesitant to take even 20 cc. of blood for another graft.

The father was again consulted and at this time I decided to use the plasma and cell extract, as well as the skin, from the father.

Fig. 4. Shows photograph of the area of the thigh taken two days after the removal of a covering composed of fibrous tissue and elastic elements. This is the appearance five months after the first application of heterogenous graft as described in Case vii.

By doing this the child did not have to go through any more inconvenience than an ordinary redressing.

The procedure was done and two drums full of skin, the same size as the first one, were taken and applied to the pelvis and buttock. These grafts also showed a complete take.

However, the girl was not even one-half covered. The father could not donate any more skin and the mother was unwilling to do so and we were anxious to continue the improvement as rapidly as possible. It was then decided to try a heterogenous iso-graft with a stock blood plasma and cell extract. The results of this were also excellent.

In extensive burns, the heterogenous graft with the stock plasma or homologus plasma should be an excellent treatment. This will be done as soon as the cases present themselves. If early grafting can be done, the mortality rate will be decreased, the number of shock cases will be lessened and deformities reduced to a minimum.

I am reporting the following cases of skin grafting by the coagulum contact method, in order to further substantiate the claims of the results obtained by Dr. Machfeld E. Sano:

Case i. A female, age twenty-eight years, had received a third degree burn on June 10, 1943, resulting in contracture of the axilla in adduction. Grafting was done on December 4, 1943, using a graft of .018 of an inch in thickness. Due to the extremely high recess in the apex of the axilla, a stitch was placed to prevent the graft from inverting itself. Vaseline gauze, plain gauze and adhesive were used to keep the gauze in place. The result was very good.

Case ii. A female, age fourteen years, was burned at the age of six years. The result was axillary contracture and scar. The scar was removed and grafting done on December 11, 1943, using a graft .016 of an inch in thickness. The result was excellent.

Case iii. A male, age forty-eight years, had a cicatricial ectropion secondary to removal of carcinoma of the left cheek. The scar was excised and a tarsorrhaphy according to the Wheeler technic was done. A full thickness graft from the medial side of the left arm was taken, freed of all fat and applied to the defect. The graft showed an excellent take when the first dressing was done five days later. The second dressing was done later and a split in the graft showed and it appeared dry. There was some purulent material about the graft and it had retracted some from the margins. The patient still has a fair result. I was advised by the resident surgeon and the dressing nurse that the patient

was very unco-operative and removed the dressing because it itched.

Case IV. A female, age thirty, had a third degree burn on the posterior two-thirds of the leg and popliteal space on October 1, 1943, resulting in a granulating surface that was not healing. This patient was grafted on December 18, 1943. A graft .016 of an inch thick was used and the result was excellent.

Case V. A female, age fifty-two, suffered a third degree burn of scalp, face and hands on November 3, 1943. This patient's burned area was grafted to prevent, if possible, any facial deformity. The area was granulating and was slightly infected. A .020 of an inch graft was made and the usual dressings applied. There was a complete take of all the grafts. The graft which was 10 cm. by 15 cm. was split into three parts.

Case VI. A male, age thirty-eight, had a keloid of the neck about 1 cm. thick, extending from ear to ear and from the border of the mandible to the clavicle. This keloid had been subjected to a long series of *x*-ray treatments prior to surgery. The keloid was resected and hemostatis obtained. The raw area produced was covered with a graft .022 of an inch in thickness. Because of the angle of attachment at the border of the mandible, I believed it advisable to tack the margins above to prevent the graft from sliding down. About four sutures were placed. This graft was fitted well. A vaseline dressing was applied. The first redressing was done about the fifth day. The graft looked a deep purple, except in one area at which there was a blister. This was opened and a seropurulent material was expressed. A white appearing necrotic tissue about 1 cm. in width and about 2 cm. in length was excised. One very small area near one corner also had to be removed. The graft showed about a 90 per cent take. It was noted as the margins of the necrotic tissue were separated that the remaining tissue was highly vascular. A 5 per cent sulfathiazole ointment was then applied. The infected areas cleared up. There were several areas of granulation that were touched up with silver nitrate and a good result was obtained.

Case VII. A female, age twelve, had a third degree burn of the entire right side of the body including the entire upper and lower extremities. This was the neglected case described previously. All areas were granulating and the patient's condition was poor. The child was apprehensive and whining and had a septic temperature. Sulfonamides and eight transfusions were given.

In this case the heterogenous graft with the patient's plasma and cell extract was used. The result was excellent. A graft .014 of an inch in thickness was used. The area was redressed on the third day and showed a much lighter purple color than the grafts that were used on clean fields. After two weeks, there was marked improvement.

Case VIII. Same child as above in Case VII except that at this time, the father's skin and his plasma and cell extract were used. The granulating area was infected, but apparently it made no difference insofar as the graft was concerned. This case will be watched to determine the length of time and ultimate fate of the heterogenous graft. Thus far the results have been satisfactory.

Case IX. Same patient as in Case VII except this reports the third operation. An outside donor with a stock plasma and cell extract were used. The results were excellent.

In the few cases here reported, I have noted that the grafts do better on granulating surfaces. I have also noted that the color five days after grafting on granulation tissue, seems reddish, while the grafts on new bases appear more purplish. The grafts on the cheek and the one on the pectoral region became corrugated and dry. I cannot account for this observation at this time.

There is some slight difference in the technic of the last few cases. Dr. Sano removes the graft and places it upon a piece of gauze and then paints on the cell extract. I paint the cell extract on the graft while it is still on the drum, when the Padgett machines are used. In freehand grafts and in full thickness grafts, when they are dissected, it is of course obvious that the graft must be placed upon some type of material. I believe that painting the cell extract on the graft while still on the drum might be advantageous because the fluid has a better opportunity to fill all the interstices and after it is removed from the drum, the graft shrinks,

but the entire surface of the graft will have been covered, with the result that it has a better chance of agglutinating to the entire surface.

In two instances I used impregnated vaseline gauze covered with a layer of 5 per cent sulfathiazole ointment, because the area was definitely infected. The results were excellent. I am not attributing the result to the sulfathiazole ointment, but it may play an important rôle in infected cases. It certainly does no harm to use it. In the remainder of the cases, I used impregnated gauze only with one exception —the neck graft which showed an infected blister. In this case I switched to 5 per cent sulfathiazole ointment. The results were good.

In redressing the above patients, I used a warm saline pack or compress for a few minutes before re-applying the dressing. In some cases I used a bulb syringe and irrigated with the warm saline solution, and I cannot see any difference.

Complete hemostasis must be accomplished in all cases before the grafts are applied.

I believe that Dr. Sano has made an important contribution to the subject of skin grafting, and I wish to express my deep appreciation for the wonderful work she has done.

REFERENCES

1. Sano, M. E. Experimental results of coagulum method of skin grafting. *Am. J. Surg.*, 61: 105, 1943.
2. Parker, R. C. Methods of Tissue Culture. P. 36. New York, P. B. Hoeber.
3. Sano, M. E. A coagulum contact method of skin grafting, as applied to human grafts. *Surg., Gynec. & Obst.*, 77: 510–513, 1943.
4. Fomon, Samuel. The Surgery of Injury and Plastic Repair. Baltimore, 1939. The Williams & Wilkins Co.
5. Smith, F. E. Reconstructive Surgery of the Head and Neck. New York and Edinburgh, 1928. Thomas Allen and Sons.

THE IMPORTANCE OF LATENT HEPATIC DISEASE

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THIS study was made from the point of view of the surgeon, who, during the course of operation upon the liver and/or the biliary tract, encounters changes in the gross appearance of the liver which indicate to him that previous disturbance had occurred therein, and which either may or may not have pathogenetic relation to the present lesion. In either case it becomes necessary for the surgeon to form a judgment regarding any such possible relation, and to evaluate the resultant damage to the liver with the object of determining the immediate and late prognosis both from the standpoint of the previously existing lesion, from the standpoint of the effect of the latter upon the present lesion, and, as a consequence, the resultant effect of both.

This study will, therefore, contain: First, a resume of the available knowledge of the biological and pathogenetic development of the metabolic and/or toxic cellular degenerative and necrotic changes in the liver parenchyma including both experimental and clinical data; second, the relationship of inflammatory lesions in the gallbladder and biliary tract to these liver changes either as its consequence or as a pure coincidental phenomenon; third, the potential effect of the liver changes in influencing the prognosis after operation upon the gallbladder and/or the biliary tract; fourth, the precautionary lessons to be learned in safeguarding such operations in the presence of pre-existing hepatic disease.

The terminology of the actual anatomical changes present in liver disease as reported in the literature, reveals a variety of terms apparently intended in part to cover the same fundamental changes. They may be roughly classified as fatty infiltrative changes, various forms of degenerative change, ranging from mild hyaline changes to actual necrosis, acute, subacute and/or chronic hepatitis, acute and/or subacute forms of yellow atrophy, and the various cirrhoses. Frequently the same liver reveals various degrees of all or many of these changes in different areas. Occasionally, the forms of yellow atrophy are confounded clinically with the hyperacute variety of acute cholangitis. An attempt will be made to clarify this apparent confusing terminology as the subject is being developed in this communication.

Practically all of these destructive changes in the liver parenchyma are ultimately followed by connective tissue changes, and the resulting fibrosis is customarily known as "cirrhosis." The term was originally used for a clinical group associated with alcohol as a causative agent and with the name of Laennec. When applied to other forms of hepatic fibrosis the term is, therefore, misleading. It seems better to use the expression "chronic interstitial hepatitis" as a generic term for all forms of hepatic fibrosis and to limit the term "cirrhosis" as previously indicated. Similarly, the term "biliary cirrhosis" should be employed for a special group of cases. The use of some person's name as a distinguishing mark of a certain group, e.g., Hanot's Budd's or Laennec's cirrhosis, is unfortunate as it gives no inclination by itself of the essential pathological lesion and/or disturbance.

METABOLIC HEPATIC CELLULAR CHANGES AND REGENERATIONS AND THEIR RELATION TO CONNECTIVE TISSUE PROLIFERATION

Normal and Pathological Fat Metabolism. Ordinarily fat is not accumulated in the liver. Fatty infiltration of the liver occurs in those conditions in which, because

of lack of intake or absorption of food, fat is mobilized from the existing fat depots, and in which the accumulated fat cannot be broken down for use. Coope and Mottram noted some increase of fat in the liver during pregnancy and lactation in rabbits. Neutral fat may be found in small amounts after a meal containing a great deal of fat, but it is probable that in most other instances in which neutral fat may be demonstrated, grossly or microscopically, the condition is due to some interference with normal carbohydrate-fat catabolism and is pathological. The conditions in which fatty infiltration may occur or be produced experimentally include: (1) A diet in which carbohydrates are decreased to a minimum or are absent (meat diet in an herbivorous animal); (2) the wasting diseases—tuberculosis and malignant tumors particularly, in which there may be a demonstrable lipodemia; (3) disease of the intestinal tract accompanied by diarrhea; (4) poisons as ether, chloroform, carbon tetrachloride and alcohol definitely interfere with carbohydrate metabolism, and so with the proper oxidation of fat;[37,62,93,95] (5) severe inanition. To some extent it is present in subjects who have been dying slowly and who are either not eating enough or not assimilating their food. In the first instance it results from external starvation, in the second, from what may be called internal or tissue starvation. This was produced in experimental animals by Dible and Libman.[24] (6) The moderate infiltration of the liver found in vitamin B_1 deficiency is probably due also to the influence this substance has on the proper oxidation of carbohydrates.[20,36,92,93,102] Lipschitz and his co-workers found that vitamin B_1 deficiency was followed by serious impairment of the pyruvic acid metabolism in the liver and by deranged carbohydrate metabolism in the entire organism.

The accumulation of fat in the liver does not seem to be a static phenomenon. Fat passes into and out of the liver freely and with astonishing rapidity. When a sufficiently large amount of fat remains in the liver, serious metabolic and mechanical effects follow including mechanical pressure and local tissue anoxemia.

HEPATIC CELLULAR DEGENERATION AND NECROSES, PRODUCED BY VARIOUS CHEMICAL AGENTS, AND THEIR RELATIONS TO PROLIFERATIVE, HYPERTROPHIC CONNECTIVE TISSUE CHANGE

A review of the experimental work shows that numerous agents, most diverse in character, are capable of causing these changes. They include various chemicals, both organic and inorganic, certain drugs and tar-like substances, foreign proteins and products of protein decomposition. More particularly, degeneration and necroses of various forms, character and extent have been produced: (1) *With phosphorus:*[23,73,131] Very profound phosphorous effects have been associated with hypertrophic intralobular connective tissue changes. (2) By arsenic:[79,83,89,100,131] These are clinical observations, of course, because of the effects of the salvarsan and similar arsenicals. *With lead:*[39,61,131] In 1900 and 1901 cirrhosis occurred as a complication in the outbreak of arsenical poisoning which occurred in the English Midlands. It was thought to be due to a contaminated beer supply. (3) *By manganese:*[3,27,46,53,78,97,131] (4) *With copper:*[4,29-43,44,48,74,75,91,94,109,123] Copper which may contaminate spirits and is used to color peas has been incriminated as responsible for hemochromatosis and its accompanying cirrhosis.[131] (5) *With silica:* Experimentally, chronic poisoning by colloidal silica produces hepatic cirrhosis[39] but this effect has not been established in man. (6) *With various organic compounds:* A wide variety of organic chemicals and substances of protein composition have been used experimentally with resulting damage to the liver. Immune sera and anaphylactic reactions have resulted clinically in necroses of liver cells of varying

degrees of intensity, in chronic inflammatory changes, and in varying degrees of fibrosis up to marked cirrhosis with obliteration of lobular pattern.

EFFECT OF ALCOHOL WITH OR WITHOUT OTHER ASSOCIATED AGENTS

Effect of Alcohol Alone. A summary of the large amount of the experimental work in which alcohol was used to produce cirrhossis can be found in numerous papers.[10,38,54,58,66,88,103,107,108,121,131] Ethyl and amyl alcohol were the forms of alcohol most often used, and the experiments have most commonly been done on rabbits. Unfortunately, these experiments are difficult to evaluate because rabbits frequently develop a form of chronic hepatitis with cirrhotic changes spontaneously.[27,113,121,131] No cirrhosis has been reported in experiments with alcohol in animals other than rabbits. Several observers stated that the livers of dogs, rats, guinea pigs, etc., were much more resistant, and based their conclusions on the rabbit experiments claiming that rabbits were especially suitable for these experiments. Although the majority of these experiments, probably, have no etiologic significance in the development of human cirrhosis, the investigations have contributed greatly to an understanding of the biological mechanism whereby cirrhosis develops.

The belief that cirrhosis is caused by alcohol has not received experimental support. Alcohol alone produces fatty infiltration in the liver[63,106] and it increases the rapidity and degree of infiltration of a high fat diet[13] by interfering with tissue oxidation.[7,50,81] Van Wulfften Palthe showed that death from a lethal dose of alcohol can be prevented by oxygen inhalation. A relative and sometimes absolute starvation is constantly associated with severe chronic alcoholism and the development of fatty infiltration of the liver most often depends on a combination of these two;[102] and it appears as indicated previously, that the dietary deficiency is in itself detrimental to the normal liver physiology.

A significant experiment with negative results was done by Friedenwald[33] under the auspices of the Committee of Fifty in which whiskey or absolute alcohol were used. The fatty changes noted in the liver, heart and kidneys of a large majority of the animals were only temporary in nature and in those animals in whom treatment with alcohol had been discontinued, they were entirely absent.

Effect of Combinations of Alcohol with Other Agents. It is significant that combinations of agents have been found more effective than either of the same agents alone, and that in these combinations alcohol is the most frequently found component. It seems reasonable to assume that alcohol acts in these combinations as a contributing, predisposing or adjuvant factor. In this respect alcohol has been found to accentuate the injurious effects of phosphorous, manganese, hydrazine, chloroform, carbon tetrachloride, cholesterol, bacterial infections, and the effects of diet in experiments with phosphorous, chloroform and carbon tetrachloride. It is probable that alcohol may similarly accentuate the effects of other injurious agents upon the human liver and so be in reality only an important contributory factor in the development of human cirrhosis.

Effect of Hydrazine, Tars, Amyl Alcohol, etc. The production of cirrhosis by means of amyl alcohol, hydrazine, tars and similar organic chemicals has duplicated rather accurately the picture of the Laennec lesion (gross and microscopical histological changes, splenic changes, ascites, etc.). This seems to have an important clinical bearing: (1) Because it has been suggested that intemperance has been productive of hepatic cirrhosis by virtue of the content of liquors other than ethyl alcohol, e.g., amyl alcohol; (2) because hydrazine, tar and/or tar-like bodies of the benzene series are formed by the charring of the casks used in the aging of liquors and it is possible that these substances so formed may be the actual agents

for the development of clinical cirrhosis and not the alcohol; and (3) copper and arsenic, previously referred to are commonly found as contaminants in beer and other liquors and are similarly implicated.

Effect of Chronic Alcoholism. Although alcoholism is a very frequent antecedent of portal cirrhosis, its action as suggested above, is probably indirect, namely, in part by reducing the resistance of the liver cells and in part by favoring intestinal infection and catarrh and so the production of poisons which are then able to act on the liver cells. Thus the combined actions of two factors may be successful, though isolated they fail, in inducing cirrhosis.

The cirrhosis of the liver observed in chronic alcoholism is probably the most important of various forms. New experimental evidence developed by Gyorgy and Goldblatt[40] of Western Reserve University suggests the possibility that nutritional factors are involved in the development of this form of damage to the liver. Experimental work with animals indicates that the essential cause of alcoholic cirrhosis in man may be a low protein intake associated with a deficiency of the vitamin B complex.

EFFECT OF CONDIMENTS, SPICES, ETC., AND OF INTESTINAL DECOMPOSITION PRODUCTS

Chronic interstitial hepatitis may be due to spices and other condiments taken with the diet, such as curries, pepper, ginger and other stimulating foods; these may lead to the formation of toxins or of fatty acids, such as butyric, lactic, acetic, and valerianic,[12] which, like paracresol phenol and indican,[84] have been shown experimentally to induce cirrhosis. To this dyspeptic cirrhosis, which probably occurs mainly in persons with defective resistance of the liver, Hanot, gave the name Budd's cirrhosis. It is sometimes hard to draw a line between poisons produced in the intestine as the result of digestion and/or decomposition and the influence of the ingested substances themselves. Vinegar and mussels[132] have also been regarded as capable of producing cirrhotic changes.

HEPATIC CELLULAR DEGENERATIONS, ETC., OCCURRING IN CLINICAL CONDITIONS

In Toxemia of Pregnancy. Pathologically, scattered areas of hepatic lobular necrosis appear with some frequency in a certain proportion of cases of pregnancy complicated by "toxemia." It is to be noted that in pregnant patients necrosis of the hepatic cells begins in the periphery of the lobule and increases progressively toward the center, whereas in non-pregnant patients presenting the hepatorenal syndrome the cellular necrosis begins in the center of the lobule and spreads toward its periphery.

Some importance must be added to this because of the infrequency with which cholelithiasis seems to originate in the metabolic changes with the physiologically abnormal fat and cholesterol metabolism during pregnancy.

Chloroform Poisoning. Delayed chloroform poisoning* appears to be much more common in obstetrical than in other types of patients. According to Sheehan it occurs in the following anatomical differentiation: (1) In the isolated-cell lesion group, the result appears to be due to an overdose of chloroform in a healthy subject. Microscopically there is a lesion with a peculiar affinity for certain individual cells in the liver columns, leaving quite untouched other cells between the damaged ones. The affected cells are about twice the normal diameter, ballooned to a spherical shape and have clear, non-fatty

* Delayed chloroform poisoning is almost entirely confined to patients who have a gross metabolic disturbance before the administration of the anesthetic. The factor of a starvation acidosis appears to be common to all cases. Sheehan[111] emphasizes that the patient who has been left in labor for a few days without adequate treatment is extremely susceptible to what may be regarded rather as a poisoning by delayed chloroform anesthesia than as a delayed poisoning by chloroform. Repetition of chloroform anesthesia after an interval of a day or two may lead to damage if the patient has been allowed to develop acidosis after the first anesthesia.

cytoplasm with pyknotic nuclei. (2) The mid-zonal necrosis group is the most common type of lesion in obstetrics. Microscopically, the essential lesion is a variable but quite universal mid-zonal necrosis. There is no evidence that sepsis plays any part in the production of the liver lesions. (3) *The central necrosis group:* This form is usually associated with hyperemesis, gravidarum, and interruption of pregnancy in a patient insufficiently nourished, and is usually fatal. Microscopically, the central zone and the inner part of the midzone of the liver are completely necrosed, the outer half of the midzone shows a definite fatty change but appears visable, and the periportal zone is intact.

In Association with Estrogen Therapy. Very large doses of the natural estrogens-estrone, estradiol benzoate and the synthetic estrogen diethyl-stilbestrol produce changes in the liver, consisting of fatty and hydropic degeneration, confined chiefly to the middle zones of the liver lobules with slight shrinkage of the hepatic cells centrally. Moderate amounts of intracellular and extracellular hemosiderin in fine granules are present in the central zones together with a few polymorphonuclear leukocytes.

MacBride, Castrodale, Helwig and Bierbaum[69] found that in general, alterations in the parenchymal cells were not widespread or prominent. Since these changes occurred before the appearance of any hemorrhagic state, they were presumably the result of direct action on the liver. Extramedullary myelopoiesis occurred within the livers of animals receiving these estrogens. These workers found that the amount of glycogen present within the livers as determined by Best's carmine stain showed considerable variation but was usually scanty. In no instance could glycogen be demonstrated in the large clear vacuoles. No correlation could be established between the amount of glycogen present and the degree of fatty and hydropic degeneration.

It seems unlikely that the usual therapeutic doses of diethylstilbestrol or of the natural estrogens will produce hepatic damage clinically, and MacBride, Castrodale, Helwig and Bierbaum[69] have not been able to detect by clinical observation or tests of hepatic function any evidence of damage to the liver among a large number of patients treated with diethylstilbestrol.

Association with Thyrotoxicosis. There are many observations on the simultaneous occurrence of exophthalmic goiter and chronic interstitial hepatitis.[5,8,42,71,96,104,125] Rössle[104] showed that marked thyrotoxicosis produces extensive hepatic necrosis. Moon's survey showed that the American states having the highest death rate from thyroid disease were correspondingly high in deaths from chronic interstitial hepatitis and vice versa. Similarly in Europe, the highest occurrence of cirrhosis on record is in Switzerland, where goiter also is most prevalent. It is known that livers with low glycogen content have an increased susceptibility to injury; and it is thought that hyperthyroidism may contribute to the development of chronic interstitial hepatitis by producing hepatic glycopenia.

Toxic Effect of Burns. There is a marked hepatic effect after severe burns. There is widespread, midzonal necrosis with hyalinization and fragmentation of the individual cells, the sinusoids are distorted but the central veins are well preserved, the liver cords are somewhat jumbled but the lobular markings are still distinguishable. According to Best,[9] it is not a liquefactive necrosis nor is it accompanied by more than slight polymorphonuclear reaction. It involves the cells somewhat unevenly, sparing some altogether, affecting others only in part. There is an associated fatty change of moderate degree which gives the cytoplasm a rather moth-eaten appearance. Councilman bodies are much in evidence. Nuclear bodies of the type described as class A by Cowdry[133] are a prominent feature.

Effect of Tannic Acid Used in the Treatment of Burns. The relationship of tannic acid used in the treatment of the burned area to this constant pathological change in four clinical cases was suspected and investigated experimentally by Wells, Humphrey and Coll.[126] Seventy-seven rats maintained either on a standard or house diet were given subcutaneously one or more injections of a 5 or 10 per cent solution of tannic acid. At the postmortem examination of these animals, depending on the amount and the frequency of the injections of tannic acid solution, the microscopic findings included central necrosis, and all stages of hepatic cell degeneration, hemorrhage, and leukocytic infiltration. Wells, Humphrey and Coll[126] assume, therefore, that the use of tannic acid resulted in the liver damage.

OBSTRUCTIONS IN THE BILE RADICALS AND DUCTS AND ITS RELATION TO INTERSTITIAL CONNECTIVE TISSUE PROLIFERATION—OBSTRUCTIVE BILIARY CIRRHOSIS—LEGATION OF THE CHOLEDOCHUS—BILIARY STASIS

Obstructive biliary cirrhosis, consisting in fibrosis spreading out from, and due to obstruction of the bile ducts, has caused much debate. In clinical medicine obstruction of the common bile duct, for example by carcinoma of the head of the pancreas, is very rarely associated with fibrosis of the liver, although it causes dilatation of the intrahepatic bile ducts, icteric necrosis and atophy of the liver cells. In gallstone obstruction of the common duct the results are not so constant: in some instances cholangitis and pericholangitic fibrosis is present; in others the liver resembles that in aseptic obstruction of the ducts by a growth. The hepatic fibrosis associated with congenital obliteration of the ducts has been regarded by John Thomson, Beneke, Ford and Lavenson[119] as due to the obstruction of the ducts, but the obstruction of the ducts may be secondary to a descending inflammation from the small intrahepatic ducts which is responsible for or is associated with a preexisting fibrosis. In a study of 184 cases of interstitial hepatitis ascribed to obstruction Mangelsdorf[77] found that there was no constant form of fibrosis.

Experimental ligation of the choledochus has been performed by various authors who have described a typical biliary cirrhosis as the result of the intervention. The liver was slightly increased in size and histological examination revealed extensive new formation of connective tissue, the picture being identical with that of the fibrosis seen with biliary stasis. The greater severity of the lesions found in these animals was undoubtedly due to their longer survival and, as any effective influence of infection could be excluded, there remained only biliary stasis as the direct cause of the hepatic changes.

Rous and Larimore[105] found experimentally that septic obstruction involving the larger bile ducts causes a stellate fibrosis around them; obstruction of the small bile ducts in the portal spaces is followed by a pure unilobular fibrosis; and obstruction of the intralobular bile canaliculi leads to a diffuse intralobular fibrosis. The diversity of the hepatic changes depends on differences in the duct levels at which the injurious factor is active. McMaster and Rous[82] have also shown that obstruction of the common duct, when the gallbladder is able to perform its concentrating action, leads to distention of the intrahepatic ducts with thick tarry bile; whereas when the gallbladder is functionless the fluid distending the ducts is "white bile," and the condition may be described as a "manifest hydrohepatosis."

MISCELLANEOUS LIVER CONDITIONS ASSOCIATED CLINICALLY WITH CHRONIC PRODUCTIVE CONNECTIVE TISSUE CHANGE

Various forms of chronic productive hepatitis are found with a miscellaneous group of conditions including: chronic cardiac engorgements; thrombosis of the

hepatic veins; surrounding foreign bodies, or areas of hemorrhage; around parasitic cyst formation (echinococcus, etc.); around tumor formation, abscesses, or areas of typhoid degeneration; in hemochromatosis, anthrocotic conditions and in malaria.

An incomplete or partial obstruction of the hepatic veins may cause complete fibrosis of the lobe or lobule of the liver involved, with symptoms similar to those found in complete obstruction but less severe.

Cases of disease of the right ligament of the liver in the literature are very rarely associated with vascular changes similar to those occurring in cirrhosis of the liver. Nevertheless, these forms of chronic productive connective tissue change should not be confused with true cirrhotic conditions as the term is generally understood.

COMPARATIVE PATHOLOGIC STUDIES

Chronic Interstitial Hepatitis in Wild Animals. The long debate as to the primary factor in cirrhosis,* primary parenchymatous change with replacement fibrosis, or primary connective tissue aggression, is interestingly met by Herbert Fox,[31] in the corresponding study made in wild animals confined in a zoological garden. The following classification was used in the animals: (1) Scar tissue, therefore, an end or result following toxic degeneration in the liver (so-called toxic cirrhosis); (2) pigment cirrhosis; (3) portal cirrhosis with enlargement or atrophy of the alcoholic or Laennec type; (4) biliary or Hanot cirrhosis with enlargement or atrophy or obstruction, with manifest inflammatory lesions within and around the biliary canaliculi; (5) specific cirrhoses, tuberculous, syphilitic, and Pictou cattle cirrhosis of Adami (?); (6) perihepatitis and perilobular fibrosis, and (7) passive congestion cirrhosis.

The animals were fully developed and therefore classed as adult. There were seven males and nine females; of one the sex is not recorded. The time in the garden merely indicates how long the animals have been fairly under uniform conditions of life. There are naturally no clinical data available during the life of the animals and the conditions were not diagnosed or even suspected before the postmortem examination.

In the accompanying Table Fox[31] tabulated the pertinent data of seventeen instances of cirrhotic liver disease which he has encountered in such animals. (Table 1.)

The portal cirrhoses are represented by four cases, of which all showed notable hepatic pigmentation but no jaundice; one had intestinal varices, but no hemorrhages are recorded. In the four portal cirrhoses, three chronic and one subacute case of splenitis were noted. All cases of portal cirrhosis had chronic interstitial nephritis, while six of the biliary type had chronic changes and one had acute changes in the kidneys. In none of the cases was there pancreatic disease. On the other hand, ten of the seventeen cases showed changes in the spleen. In the biliary type, five cases of splenic inflammation existed, four being chronic and one acute hemorrhagic. The odd cases were diagnosed by Fox[31] as perihepatitis and passive congestion fibrosis, a typical Laennec's or Pictou cirrhosis of Adami, and perilobular fibrosis.

It appears from this record that in the pathology of cirrhosis of the liver in wild animals confined in a zoological garden the common systemic causes usually present in humans—alcohol, syphilis, lead, etc., can be excluded from the pathogenesis of this disease. Fox emphasized the small percentage of these cases, which showed, clinically, disturbance of the gastrointestinal tract. Nevertheless, he comments upon the frequency with which infections in these animals emanate from the intestinal tract. Ulcerating lesions are more common in the intestines of animals than they are in man. This may permit food or protein poisoning which if repeated suffi-

* The term "cirrhosis" and the other terminology in this section are those employed by Herbert Fox in his paper.

TABLE I

No.	Common Name	Type of Cirrhosis	Age	Sex	Time in Garden	Gastrointestinal Lesions	Spleen	Kidney	Varices	Liver			
										Size	Fatty	Pigmentation	
421	Bubaline antelope	Biliary	Adult	Fem.	11 yr.	Chronic	Moderate chronic splenitis	Chronic diffuse nephritis	.....	Small			
754	Common racoon	Portal	Young	Fem.	Few days	Chronic	Moderate fibrosis	Chronic diffuse nephritis	.....	Normal	+	+	
969	Japanese Macaque (Tuberculous)	Biliary	Adult	Male	Few months	.....	.....	Chronic interstitial nephritis	.....	Normal	....	.....	No evidence of T.B. in liver
1112	Levaillant's Amazon	Biliary	Adult	?	?	Chronic Tuberculous Enteritis.	.....	?	.....	Small	....	+	
1153	Gray Wolf	Perihepatitis and Passive Congestion	Adult	Male	Six yr.	Chronic	Moderate fibrosis and congestion	Subacute diffuse nephritis	Intestines	Large	+	Slight	Myocarditis ascites
1416	Fallow deer (tuberculous)	Biliary	Adult	Male	One yr.	.....	.....	.....	.....	Large	....		
1461	Indian elephant	Portal	Adult	Male	Twenty yr.	.....	Fibrosis and pigmentation	Chronic parenchymatous nephritis	?	?	....	Normal	
1539	Red brocket	Biliary	Adult	Fem.	Four yr.	.....	Hemorrhage	Chronic parenchymatous nephritis	.....	Normal			
1669	Virginia deer	Biliary	Adult	Male	Two yr.	.....	Chronic splenitis	Chronic parenchymatous nephritis	.....	Small			
1857	Capybara	A typical Laenneor Pictou	Adult	Fem.	Nine mo.	.....	.....	.....	.....	Small	Slight		
2516	Clouded leopard	Portal	Adult	Fem.	Eleven yr.	.....	Chronic splenitis	Chronic interstitial nephritis	.....	Small	....	+	
2536	Black tailed Wallaby	Biliary	Adult	Fem.	Two and half yr.	.....	Chronic splenitis	Acute parenchymatous nephritis	.....	Large	....	+	Choledochitis
2590	Texas skunk	Portal	Adult	Fem.	Four yr.	Acute gastritis	Subacute splenitis	Chronic diffuse nephritis	Intestines	Small	+	+	
2850	Indian paradoxure	Biliary	Adult	Male	Twelve yr.	.....	Chronic splenitis	Chronic interstitial nephritis	.....	Large	....	+	
2950	Mexican guan	Biliary	Adult	Fem.	Four yr.	.....	.....	.....	.....	Normal	+	+	
3119	Common racoon	Perilobular	Adult	Fem.	Seven yr.	.....	.....	.....	.....	Normal	....	+	
3199	Aoudad	Biliary	Adult	Fem.	Ten yr.	.....	Congestion	Chronic parenchymatous nephritis	.....	Small	....	+	

ciently often, may initiate changes in the liver parenchyma. The view held in many quarters that the forms of biliary cirrhosis all find their origin in infection seems to be corroborated by the proportion of ten cases in the seventeen studied, in which a frank progressive, inflammatory condition was found. The very frank infectious forms in these animals were progressive with active interstitial cell and fibrous tissue but with little tendency to intralobular penetration. When the latter was found it was nearly always present near the capsule or hilus of the liver. Taking it all in all, this comparative study will tend to emphasize the infectious origin as being commonly responsible for hepatic cirrhosis.

Chronic Interstitial Hepatitis in Domestic Animals. Enzootic hepatic cirrhosis has been described by Kalkus, Trippeer and Fuller[55] in horses ("walking disease"), occasionally in cattle, and not uncommonly in hogs ("hard liver disease" or "Walla Walla* hard liver disease"), in the wheat-producing regions of the Pacific Northwest and in certain sections of Idaho and Oregon where the condition is more generally known as "protein poisoning" or "winter wheat poisoning" because its occurrence has been associated with the feeding of certain diets, especially those high in winter wheat.

The most striking pathological change found was an extensive destruction of the hepatic tissues and replacement with fibrous tissues. In very acute cases the liver was swollen; in more chronic cases, it was shrunken and extremely hard. In one chronic case, adhesions had formed between the lobes of the liver, and the wall of the gallbladder was extremely thick and fibrous. In the absence of an unusually severe anemia, icterus is pronounced. In the early cases in pigs there was a beginning necrosis of the cells.

Swine which had been allowed to continue on experimental feeding with the seeds of tarweed—Amsinckia Intermedia—revealed at death an extreme hypertrophic cirrhosis of the liver with hyperplastic and toxic changes in the remaining parenchyma. The lobular architecture was obliterated and the connective tissue exceeded the parenchyma in amount. The parenchymal cells often were greatly enlarged and some contained several nuclei, as if from confluence of several cells. In some of the sections examined, not more than four or five normal hepatic cells appeared in a microscopic field. The spleen also was involved and in many of the acute cases was enlarged, while in the chronic cases it appeared to be somewhat fibrotic. The kidneys were hemorrhagic in some horses and the bladder filled with blood-stained urine.

Comparative Human Experience. This animal experience should be compared with the following report of one in humans: In 1918, certain cases of sickness of obscure causation occurred in the George district of Cape Province. Whole families had suffered from time to time from a complaint the chief symptoms of which were abdominal pain and vomiting, with ascites. Investigations showed that the plants known as Senecio ilicifolius and Senecio burchelli grow as weeds in the wheat fields at George, and that when the wheat is threshed the seeds and portions of these plants frequently remain behind and are solid with the wheat. Experimental animals fed on portions or seeds of these plants developed symptoms and mainfested post-mortem appearances similar to those noted in man.[134]

Leonard Rogers[135] considers that chronic amebic hepatitis is a frequent cause of chronic interstitial hepatitis in India. Poisons manufactured in connection with the presence of uncinaria duodenalis and bilharzia hemotobia in the intestine have been thought to cause these liver changes among Mohammedans in Egypt and in South African natives.[136] The occurrence of pigmented cirrhosis in connection with the rare occurrence of foreign bodies such as particles of carbone or stone in fibrotic

* So-called because many cases have been observed in Walla Walla County, Wash.

livers is referred to elsewhere. An endemic form of unicellular interstitial hepatitis with hepatic enlargement, jaundice, and continued fever, but without splenomegaly was described in 1897 by Carmono y Valle[130] in Mexico. Ascites is often present and the disease runs a rapid course in six to eight months.

Geographic Distribution of Cirrhoses. Chronic interstitial productive connective tissue change in the liver is found in all parts of the world. Cirrhosis of the liver may be found as frequently in some countries where alcohol is used but little as in others where its use is habitual, but a common predisposing factor is present in each instance, namely, failure of alimentary absorption. Cirrhosis is mainly seen in chronic tipplers, not in spasmodic drinkers. During the war restriction in England and Wales of alcoholic stimulants appeared to be correlated with the fall in the death rate from cirrhosis from 4,148 in 1914 to 1,730 in 1918,[115] and in Chicago the deaths from cirrhosis appeared to fall after the introduction of prohibition.[86] But that alcoholism is not an exclusive antecedent of cirrhosis is proved by the incidence of the disease in life-long abstainers and Mohammedans.

Yenikomshian[129] found that cirrhosis is particularly prevalent in the rural population of Tyre and Sidon where alcoholic drink is taboo. A history of amoebiasis (dysentery) or malaria was regularly found in such cases and he believed that a combination of the two is the most important cause for cirrhosis in that population. Infestation by intestinal parasites is prevalent among these peoples, and the average age of those who acquire cirrhosis of the liver is much lower than it is in this country. According to a report by Rolleston and McNee,[101] cirrhosis of the liver is much more frequent among the natives of India than it is among white people. Records of 535 autopsies done on natives of Vizagapatam revealed that 9.3 per cent had cirrhosis of the liver. Twenty-five patients were found to have portal cirrhosis. Tirumurti and his co-worker emphasized the fact that the people of this locale do not drink alcohol. It was affirmed by Bloomfield[11] that cirrhosis of the liver may progress to a far advanced stage before it causes symptoms or produces changes which induce the patient to seek medical care and by the same token may cause the clinician to fail to make a correct diagnosis. In most instances a review of the history gives no indication as to the time of onset of the disease. Also the prognosis is uncertain because of a lack of knowledge concerning the complex alterations of metabolism that result from disease of the liver.

An infantile form of endemic biliary cirrhosis, occurring among the Hindus in India, during the first two years of life, at first as a unicellular and subsequently as a unilobular cirrhosis, has been thought to be due to toxic bodies in the food taken by the nursing mothers who restrict themselves to a dry diet and take a decoction of pepper.[137]

RELATION OF ACUTE AND CHRONIC INFECTION OF THE LIVER (HEPATITIS) TO CHRONIC INTERSTITIAL CONNECTIVE TISSUE CHANGE

Acute and Chronic Hepatitis. The discussion of the somewhat indefinitely used term "hepatitis" is beset by many difficulties. The discussion must include hepatitis as a single entity and must, nevertheless, include its very complex and diversified etiology, and its differentiation from various forms of cellular change and degeneration. It is also very difficult to establish the recognizable point at which any of these anatomical changes reach the plane of clinical observation. The problem of cellular change, varying from purely functional abnormality to various grades of cellular degeneration and destruction, must be considered as opposed to actual inflammatory change. And in the field of cellular functional or morphological change, one must note the lack of evidences of any hyperfunctional or hypertrophic change

and the universal evidence of diminution in function and destructive change in cellular morphology.

Hematogenous and Metastatic Infection. In spite of the fact that the liver is known to have a high bactericidal power,[35] infections in animals are known to be followed by chronic inflammatory changes which resemble Laennec's cirrhosis closely.[76,90] In human pathology, in all forms of general infection (typhoid, pneumonia, scarlet fever, small pox, secondary syphilis, malaria and infections by staphylococci, streptococci, etc.) there is a period when the micro-organisms are found in the blood stream. During the period when an immunity is being established, they disappear from the blood stream and are found deposited in the liver and other organs. In postmortem examinations, aside from various parenchymatous and degenerative changes, the liver shows frequently a round-called infiltration in the interstitial tissue and focal necroses. In other words, some degree of hepatitis is almost always present, often giving little or no clinical evidence of its presence. Due to some special circumstance, predisposition or sensitization, the parenchyma cells may be enough affected to interfere with their normal function of excreting bile. Jaundice, occurring under such condition, is an indication of hepatitis even though no other distinctive sign of any such lesion is demonstrable. Such forms are frequently recoverable from without causing further changes in the liver unless some additional toxic and/or other influence is brought to bear.

Metastatic inflammatory lesions are commonly found in the liver originating in intra-abdominal infections notably in the appendix or in the hemorrhoidal area. Commonly these resemble the previously described forms of hepatitis, recognizable, clinically by temperature and mild jaundice. Less commonly hepatic suppuration occurs.

Clinical Course of Acute Hepatitis. The initial stage of hepatitis may be clinically acute and promptly fatal. This group includes not only cases of so-called acute yellow atropy but also instances of a less violently destructive process, which, latterly, have been classified under the generic term of "toxic cirrhoses." An equally acute onset may be followed by complete clinical recovery and probably by healing of the lesion, although it is hard to prove that latent anatomical changes are not present. The possibility of such latent changes, which may gradually progress over many years until clinical hepatic insufficiency supervenes, is shown by those rare instances of later cirrhosis in which a story of acute hepatitis years ago can be elicited (Vide infra). It is sometimes possible to observe clinically such latent periods over long periods of time. The latent periods may be punctured by clinical exacerbations which again subside into latency, and thus such a cycle may be repeated a number of times before the patient dies. Bloomfield[11] points out the analogy between these long drawn out liver cases to the course of glomerular nephritis.[2]

ACUTE YELLOW ATROPHY OF THE LIVER (ACUTE PARENCHYMATOUS HEPATITIS)

Hyperacute Form. Acute yellow atrophy of the liver, also known as icterus gravis, acute parenchymatous hepatitis, malignant jaundice, parenchymatous degeneration of the liver or acute necrosis of the liver is the potential ultimate lesion to which any form of hepatic degeneration or hepatitis may progress. The literature contains numerous references to the fact that at one time or another examples of this progression have occurred in association with all the conditions described, e.g., toxic causes, as extreme phosphorous poisoning; acute infectious disease, as yellow fever or variola; syphilis; metastatic pyogenic infections, as erysipelas, osteomyelitis, puerperal sepsis, etc.; enterogenous cases, as those following cholangigis; autolytic cases; mushroom poisoning (oxford Medicine).

Pathologically, it is a widespread degeneration of the liver with toxic manifestations, jaundice and a reduction in the size of the liver. The term "acute necrosis" is more descriptive of the condition. It is known to occur at all ages and in both sexes, isolated from or associated with pregnancy. Since the first case of acute yellow atrophy of the liver in pregnancy described in Kerkring in 1706, most writers have referred to the relation of the disease to pregnancy. Rarely, it may be epidemic, as shown by Kent's series of fourteen cases which occurred in a period of eighteen months, all in association with pregnancy. Kent's series, however, lacks pathologic confirmation. In association with pregnancy, it is generally but wrongfully included among the toxemias of pregnancy as typical cases have occurred in man and in non-pregnant women also.[127]

A typical and severe form of the hepatorenal syndrome is, almost of necessity, part and parcel of the clinical entity. At postmortem examination the extent of the degeneration and necrosis in both liver and kidney is of maximum grade. This should be expected in view of all of the facts outlined on a previous occasion.

One cannot avoid the conclusion that acute yellow atrophy of the liver may be a primary condition or the terminal phenomenon of a variety of other conditions; that the lesion is essentially the result of the toxic action of a variety of agents; that all of these produce necrotic and/or degenerative changes, sometimes in the liver alone and more frequently in conjunction with the kidney; and that the degree, extent, magnitude and relative proportion of the hepatic and renal lesions, extending from those of least clinical importance to the maximum dramatic manifestations of acute yellow atrophy and hepatorenal insufficiency, are questions of the dosage and intensity of poison or toxin delivered in the environment of the hepatic and renal cells.

Toxic Hepatitis. There is a less hyperacute, even though frequently fatal form of the disease which is variously known as acute hepatitis or toxic hepatitis. Hepatitis in the sense of evidence of infection is not the predominant lesion, but rather extensive fatty degeneration of the central portions of the liver lobules without actual necrosis or atrophy. Fatty degeneration of the liver seems to be a more descriptive term. The onset and the usually fatal clinical course are identical with those of true acute yellow atrophy, and the location and type of lesion, that is, fatty changes in the liver cells in these central portions of the lobules, are the same. Although the liver cells in these areas are not disintegrated, that would seem to be a matter of degree rather than of kind of disease. Whitacre and Fang[127] consider this condition as an early stage of acute yellow atrophy.

Obstetric Acute Yellow Atrophy. One of the clinical forms of "toxic hepatitis" occurs in pregnancy and is known as "obstetric acute yellow atrophy." True yellow atrophy is very rare in pregnancy. Among Bergstrand's[139] seventy-two cases there was none in a pregnant patient, and in the last 400 postmortem examinations on pregnant or puerperal women in the Glasgow Royal Maternity Hospital there has not been a single example. It would appear that true yellow atrophy of the liver is so uncommon in pregnancy that it can be looked upon as a chance complication.

Obstetrical acute yellow atrophy appears to be a definite entity. Clinically, it is very similar to true yellow atrophy, but is sufficiently distinctive to make differentiation of the two diseases easy. Sheehan's[111] description is based on six cases found in the last 400 obstetrical postmortem examinations.

At autopsy the patient is deeply jaundiced. The liver is yellow and rather small. Its lobular pattern is not lost. Microscopically, all the cases showed an identical lesion; there was a gross fatty change effecting the entire lobule except a sharply defined rim of normal cells around the portal tracts. The affected cells were bloated by a fine foam of tiny fatty vacuoles throughout the cytoplasm. The

nuclei were normal and there was an entire absence of necrobiotic change. The liver lesion does not show any histological similarity to true acute yellow atrophy; there is an entire absence of necrosis in the obstetrical cases.

The cause of the disease is not known. Clinically, the condition has to be differentiated from true acute yellow atrophy; toxic necroses of the liver by chloroform, atophan, salvarsan or phosphorus; catarrhal jaundice; and cholelithiasis.

Subacute and/or Mild Form—"Healed" Forms. Classical acute yellow atrophy of the liver as described pathologically by Rokitansky[99] and clinically by Frerichs, also occurs in a mild form, which may produce none, or very few symptoms during the acute stage but ends in productive interstitial changes. This fibrosis is of a special type somewhat resembling alcoholic cirrhosis and often mistaken for it. The histologic characteristics of this type of cirrhosis have been described by Mallory,[72,73] To it he has given the name of "toxic cirrhosis." The late or "healed" stage, represents an actual chronic interstitial hepatitis in a clinical as well as a pathologic sense. Clinically, the picture is varied. Even jaundice and ascites may be absent. Mallory's investigations have furnished the connecting link between acute liver atrophy and a definite type of chronic interstitial hepatitis.

In spite of its very acute character and extensive destruction, Wilson and Goodpasture[128] do not suggest that the clinical forms of acute yellow atrophy are end results of extensive central necroses, like those which may occur following intoxication with chemical or other poisons. The lesions are essentially focal in character, do not affect the hepatic lobules uniformly, and are relatively large; there are areas of complete destruction of parenchyma interspersed with other larger or smaller relatively unharmed areas, which in time become hyperplastic. The process differs in this respect from the effect of known toxic chemical agents and suggests the presence of some local disturbance in the liver, irregular in its distribution, as an essential or contributing factor.

It does not seem justifiable, however, to diagnose and distinguish the condition of a healed liver as "toxic cirrhosis" as opposed to "acute yellow atrophy," if by that term is meant the healed end result of a central necrosis of the type so commonly seen as a terminal event after certain severe infections or after chemical poisoning. Wilson and Goodpasture[128] suggest that acute yellow atrophy should be considered as a distinct disease with characteristic acute, subacute and chronic stages, as emphasized by Strumpell,[141] Seyfarth[142] and Brütt,[143] and they consider the term "healed stage of yellow atrophy" a preferable one.

Localized Forms of Hepatitis. Localized forms of hepatitis are found most commonly in association with acute inflammatory conditions in the gallbladder when an hepatic lesion is demonstrable in the liver parenchyma for a short distance surrounding the gallbladder bed. The following lesions of the liver parenchyma have been described:

1. Interstitial or proliferative infiltrations localized chiefly in the biliary-portal spaces, and usually consisting of lymphoid elements with a few neutrophiles and occasional eosiniphiles. No vascular lesions are observed in either the portal radicles or the central veins. In only a few cases is there a proliferation of the biliary capillaries. The interlobular supporting tissue has always been found normal.

2. Less constant parenchymatous lesions usually manifested by slight, fatty cellular degeneration. Other changes are pigment infiltrations, protoplasm vacuolization, and nuclear changes. Necrosis and fibrous tissue changes have never been observed.

3. Capsular lesions are present in about 50 per cent of cases, manifested by a connective tissue thickening of Glisson's capsule.

Contrariwise, I have seen a number of instances in which acute and chronic

cholesystitis were present in livers the seat of a well formed cirrhotic condition as shown by the visible hob-nailing of the liver. Not only an exudative inflammation occurs, but various forms of degeneration, necrosis and regeneration, and various forms of productive inflammation, giving the most varied picture, extent, degree and character of interstitial and parenchymatous lesions.

The conclusion has been reached that in many cases of cholecystitis there has been a direct extension to the liver; that frequently a vicious circle exists between the gallbladder and the liver whereby each may reinfect the other; and that such infection of the liver is an important factor in the production of cirrhosis. This assumption seems to be supported by the anatomical fact that the gallbladder possesses a rich lymphatic network which pours its contents into a subserous network by lymph vessels which traverse its muscular coat,[144,145] and that the lymphatics of the gallbladder anastomose copiously with those of the liver.

Relationship of Lues to the Cirrhoses. The frequency with which a positive Wassermann reaction is obtained in cases of portal cirrhosis[65,117] raises the question of a more intimate relation between syphilis and portal cirrhosis, and Letulle[65] believes that ordinary cirrhosis may be due to syphilis. Nevertheless, syphilis has not been considered a direct cause of portal cirrhosis, the lesions recognized as due to the spirocheta pallida being quite distinct. The most that has been suggested is that after the cure of the early lesions the liver is left with its resistance so diminished that factors, which in ordinary circumstances would have been comparatively harmless, are now able to exert a sclerogenic effect.

Relationship of Tuberculosis to the Cirrhoses. The causal relation of tuberculous infection to the cirrhoses is not clear. In the uncommon case in which a certain amount of interstitial hepatis is found surrounding foci of tuberculosis, the picture is not that of the ordinary forms of cirrhosis. It is unlikely that there is any other connection than the usual scarring surrounding and resulting indifferently from most varieties of infection.

Miscellaneous Group. Some degree of hepatitis is very rarely associated with leprosy nodules in the liver,[18] and in leishmaniasis.[87] In the tropics there is a high incidence of hepatic interstitial fibrosis in association with diseases to those regions.

MIXED LESIONS

In the greatest number of the cases the dominating characteristics of the anatomical picture are sufficiently characteristic to permit a relatively easy classification of the individual instance. Nevertheless, there is occasional difficulty owing to the mixed character of the lesion which presents itself. This takes the following forms: (1) The essential lesion seems to be the atrophic type of Laennec (interlobular type) in which areas of the hypertrophic type of Hanot (intralobular type) are present. (2) The exact antithesis of the first group is present. (3) The essential anatomical picture is so distorted that no area of definite type is present, and in which the connective tissue change is unorganized. (4) The picture contains areas conforming to all of the above classification.

PATHOLOGICAL ANATOMY

PRIMARY HEPATIC CELLULAR CHANGES AND DEGENERATION

In all cases the most frequently found factors are fatty infiltration and degeneration and the use of alcohol. For this reason it seems best to discuss the resultant pathological changes together.

Effect of Fat Infiltration upon the Liver Cell—Hyaline Degeneration and Necrosis. The process of dissolution in the hepatic cell is distinguished in the chronic cases by its insidiousness. In many cases, and this applies especially to alcoholics, the hepatic cells store up fat; the cell volume distends to an extraordinary degree and

the process is then customarily known as fatty degeneration. This fatty change is the forerunner of the following changes which can also occur in the absence of excessive fat storage: There is first hyaline change; then the cell outlines lose their distinctness; later granulation may or may not appear; finally they are engulfed, or digested by the endothelial cells of the sinusoids and are completely lost from visibility.

The histological picture in the liver is a later stage of simple glycogen depletion. In the typical fatty liver as seen at autopsy, there is definite parenchymal swelling in the enlarged liver; the capsule becomes tense; and, when the condition has been present for some time, the latter loses its transparency, becomes thickened and unyielding. The surface of the liver reflects this physical condition of swollen intralobular parenchyma between unyielding interlobular septa, and becomes irregularly coarsely granular even in the absence of any productive interstitial changes. This pseudo-lobulation is especially marked during life when the liver is full of blood. The color is usually pale or yellowish red, depending upon the amount of blood present. The lobules may be bile tinged. The consistency is variable but more likely to be firm and tense. Fat is abundantly present.

The hyaline degeneration and later atrophy occurs in the peripheral cells of the liver lobule and there is an early proliferation of fibroblasts. Gradually the final stage is reached in the typical hobnail liver. The gradation of the one into the other is unmistakable even into the final interstitial fibrosis. The absence of fat in many livers during the final stages is due to the dissipation of the body fat, to the discontinuance of the alcohol consumption and the resumption of a high carbohydrate diet.

McCallum's description of the repetitive destructive changes is as follows: "The liver cells are killed in patches—whole lobules and groups of lobules at a time, or only parts of lobules. There remain irregular masses of liver tissue partly disconnected from their bile ducts. The masses of liver-cells quickly increase in size by multiplication of their cells, new capillaries are formed in every direction, and this labyrinth of cells expands, pressing the stroma way on all sides. For a time the liver-cells are normal, but then comes another injury, and many of the hyperplastic nodules are partly destroyed. The whole process is repeated, and not only once, but many times. It is clear that this must lead to an extraordinary distortion of the liver's structure. There are no longer lobules, but only nodules produced by the hyperplasia of smaller groups of cells which were left intact."

The changes occur so slowly that many years pass while they take place. Mitotic figures are infrequently seen and there are no perceptible signs of activity in the neighboring bile ducts. There is never any hemorrhage and never any signs of acute inflammation. There are little, if any signs of cell regeneration. The picture most often involves the liver as a whole. It is distinctly not the picture of an overwhelming of the liver parenchyma in whole or in part by some extraordinary lethal agent so that the individual cells are quickly killed, i.e., undergo acute necrosis.

Rôle of Cellular Anoxia. It appears that whatever the primary single or multiple causes of this abnormal biological mechanism may be, the fundamental final provocative cause of the degenerative changes is intracellular lack of oxygen. In the very stages when fat is being accumulated in the liver cell to the exclusion of, or, more, rarely, in addition to the normal glycogen content, the cells in the liver cords, because of their abnormally swollen size, compress the nutrient vascular channels (hepatic block), interfere with the normal discharge from the cells of their katabolic products (bile secretion), prevent the replacement with adequate supplies of new metabolic material, and create an environment of decreased oxygen ten-

sion and a consequent sluggishness, inhibition or change of intracellular activity. In the later and final stages of this process, anoxia of the hepatic cell is increased by the throttling effect of the contracting scar tissue. Clinical disturbances become more marked then and changes in function as shown by functional tests appear and grow more decisive. In this stage very little regressive change can occur; but if nutrition and oxygenation of the hepatic cells can be sufficiently increased, the process may be prevented, at least for a time, from increasing to the final stage from which no recuperation can take place.

Himwich[51] et al. concluded that the altered metabolism which they found after alcohol administration (increase of lactic acid, increased carbon dioxide, change of hydrogen ion concentration to acid side, and increase of sugar in blood) was due to an inhibitory effect on cellular respiration. These effects are similar to those produced by ether, chloroform and carbon tetrachloride, and it is noteworthy that the experimental cirrhoses of the liver which most nearly approach alcoholic cirrhosis was produced by carbon tetrachloride,[13,60] which has a depressent action on carbohydrate similar to alcohol, but a much more drastic action on the liver; and by phosphorus[73] which causes a fatty infiltration as well as a degeneration, of the liver.

DEVELOPMENT OF CHRONIC INTERSTITIAL HEPATITIS INTO ITS VARIOUS ANATOMICAL FORMS INCLUDING THE ATROPHIC TYPE LAENNIC (CIRRHOSIS)

Effect of Hepatic Cell Dissolution upon the Connective Tissue Framework of the Liver—Chronic Connective Tissue Proliferation. Sooner or later connective tissue proliferation begins somewhere in the environment of the lobules probably from the cells forming the walls of sinusoids. It is frequently more prominent around the portal areas. There is usually a thickening of the sinusoidal wall as the first noticeable collagen fibrils becomes swollen, forming homogeneous thicker lines of collagenous material, and a delicate reticulum can be seen to form around degenerating cells. Fibrolastic proliferations follows the fibrous strands thus formed, connect collapsed empty capillaries (sinusoids) with one another, eventually joining with prolongations from periportal connective tissue. In the average slowly developing case these strands more or less clearly define the limits of a lobule. The strands join with others coming from any direction and sometimes cut across lobules, forming the irregular lobulated pattern that has been so hard to explain.

Productive changes in the connective tissue framework continues equally slowly. Inasmuch as under these conditions whole lobules are uniformly involved, there is evidence of this accompanying change only between the lobules and not in and among the individual hepatic cells in the interior of the lobule. They are first seen in the connective tissue septa and on the peripheral rim of the individual lobules, and in the early stages of this progressive accumulation of fibrous tissue, the bulk of the entire organ increases. This is the stage in which on physical examination the lower edge of the organ can be palpated much below the costal rim. As the septa and especially the perilobular new fibrous tissue formation increases in thickness, firmness and strength, contraction of the latter occurs and whatever is encompassed within it is throttled. The remnants of the hepatic cells are now further compressed and causes, or enhances, in addition to the primary degenerative process, atrophy and shrinkage of the entire organ. The hobnail appearance of the liver is characteristic of this change. Clinically, this appears as an abnormally small liver and indicates a far advanced phase of the disease.

An unmistakable gradation from the earliest changes to those far advanced is manifest in this mechanism of production of chronic interstitial hepatitis. The absence of fat in many such livers at the end is explained by the exhaustion of body fat, by the discontinuance of alcohol con-

sumption, and by the resumption of a normal or high carbohydrate diet.

Demonstrable Transition Changes. It is a rare event for the changes which eventuate in progressive hepatic fibrosis to be demonstrable. In fully 80 to 90 per cent of the cases, there is usually no violent upheaval and destruction of hepatic parenchyma; and the symptoms are associated with a manifest sluggish, progressive lesion and with a process already far advanced. In the remaining 10 to 20 per cent, the process begins in some clinically recognizable episode of some form of acute hepatic destruction: acute hepatitis, acute yellow atrophy, toxic hepatitis, etc., and the subsequent course of events is as follows: In many of the instances the initial acute hepatitis (e.g., acute yellow atrophy) is such an overpowering episode as to result in immediate death; in some at least, of the other more fortunate ones, the acute disease is a single, not repeated incident (as, for instance, in some of the pregnancy cases) from which complete recovery follows; and, in the remainder, the symptomatology is so mild in the succession of episodes, that unless one is on the lookout, the cases escape notice and their occurrence is not recorded.

Nevertheless, in the latter, it has been possible on a number of occasions to demonstrate and study the anatomical and functional intermediate changes between the acute and/or subacute stages and the later changes and results (i.e., the "chronic" or "healed" or "cirrhotic" stage). The available information is as follows:

The periods of observation range from a few months to several years. Marchand's case was of six months' duration; that of McDonald and Milne,[80] of seven months' duration.

Bloomfield[11] was able to demonstrate in two cases definite evidences of latent hepatitis, eight and eleven years, respectively, before clinical symptoms appeared. In this connection he demonstrated the latent stage as that in which there are abnormal findings; elevation of blood bilirubin and induration of liver or spleen without any departure from health.

Wilson and Goodpasture[128] report cases illustrative of an acute, a subacute and a healed yellow atrophy of the liver. They believe that immediate recovery from acute yellow atrophy is probably more frequent than is generally believed. In the healed stage the liver is grossly and irregularly lobulated. The hepatic parenchyma is represented by irregular masses of hyperplastic liver cells, which are separated by a vascular, collapsed stroma in which the skeleton of previous lobules persist to a greater or less degree.

A series of cases are recorded by Connor[20] which show the development both clincally and pathologically of the condition known as acute yellow atrophy of the liver into definite "cirrhosis" of the liver (toxic cirrhosis of Mallory) usually not distinguishable from an alcoholic cirrhosis. The clinical history included previous attacks of jaundice often with pain, fever, and vomiting, and at autopsy there was a very small, greatly distorted liver. This form differs from the Laennec type in which symptoms of portal obstruction, and little or no jaundice form the clinical features, and a larger, less distorted liver with portal fibrosis are the pathological characteristics.

Abramson[1] found ten cases of chronic hepatitis in men between twenty and forty-two years of age in hospital material exceeding 10,000 cases of internal disorders, the causes of which were not determinable. The majority of the patients had no history of a preceding acute hepatitis. The subjective symptoms were fairly uniform and the clinical features included dyspepsia, fatigue, listlessness and depression, increasing after physical exertion and without jaundice. The period of observation was between two and seven years. Treatment never completely relieved the symptoms. The prognosis was uncertain and the possibility of a later development of cirrhosis was entertained.

Krarup and Roholm's[57] examinations of twelve cases of severe, protracted or recurring hepatitis were based on biopsy examinations and disclosed a gradual transition from the usual acute hepatitis to a fully developed Laennec's cirrhosis. Decidedly chronic changes appeared in the more active cases in the course of weeks, or insidiously over a period of several years in the others. None of the patients in question were addicted to the use of alcohol.

Whiteacre and Fang's[127] experience, also based on biopsy evidence, was the following:

The area of fatty degeneration involved three-fourths to four-fifths of the liver lobules in the first biopsy at the time when the blood chemistry indicated liver damage. The second biopsy showed intensive fatty degeneration which, however, involved only one-half of each lobule, and at this time, the chemical findings in the blood also indicated improvement.

Stander[114] reported a fatal case which was more severe but otherwise similar. One of the cases reported by Baens and Espinola also was similar.

Relation of the Distribution of the Connective Tissue Changes to the Localization of the Early Cellular Changes. In the various varieties of this condition, the localization of the cellular degeneration in the hepatic lobule has varied from the center of the lobule to its periphery. It is most likely that this is due to the path of approach of the causative agent (portal vein or hepatic artery and/or biliary passages) and/or the nature of the agent (bacterial, chemical and/or traumatic); less likely that it is due to a temporary or permanent change in the individual circulation, to a lessening of the effect of the causative agent as it progresses from the center of the lobule to its periphery or vice versa, to some other accidental distribution or action of the causative agent; or it is barely possible that it may have no biological importance.

The localization of the chronic connective tissue proliferative process occurs more or less in conformity with the character of the injury and with the localization of the area of degenerated or destroyed hepatic cells. In other cases in which an anatomically, or pathogenetically differentiated form of disease has occurred in the liver, the latter determines the distribution, character, extent and intensity of the connective tissue change. In either case, to be sure, the connective tissue change is clearly of a reparative nature, even though the objective is frequently distorted and replaced by other secondary effects as pernicious as the primary illness itself. Many of these forms of productive connective change are, therefore, unclassifiable. In only one of these forms, clinically usually associated with chronic alcoholism, the anatomical picture is clearly differentiated, i.e., the atrophic form of Laennec.

Degree of Connective Tissue Change. The relative amount of fibrous tissue in progressive cirrhosis of the "alcoholic" type was estimated by microscopic examination by Hall and Morgan[45] and recorded as slight in three cases (4.4 per cent); moderate in fourteen (20.6 per cent); marked in thirty-two (47 per cent); and extreme in nineteen (or 28 per cent). The stage of development of the lesion was judged by the maturity of the connective tissue and Hall and Morgan found fifteen cases (22 per cent) in which it was classified as cellular; eleven (16.2 per cent) in which it was classified as moderately cellular; thirty-seven (54.4 per cent) in which it was said to vary from moderately cellular to dense; and only five cases (7.4 per cent) in which it was designated as dense. The largest group (54.4 per cent) in spite of greater maturity, still showed evidence of fibroblastic proliferation, especially at the junction of fibrous tissue and liver cells and more especially about degenerating or necrotizing cells. The fact that fibrocytes are almost invariably found invading areas containing degenerating liver cells caused Hall and Ophuls to suggest that the toxic substance which destroys the less resistant liver cells serves only to stimulate the

more hardy connective tissue to active proliferation.

Considerable variability was noted in the amount of cellular infiltration of the periportal connective tissue. In most instances, the greater proportion of cells consisted of small lymphocytes as in the chronic cases. In the subacute cases, however, almost regularly a moderate number of polymorphonuclear leukocytes were present as well. In a few cases they were quite abundant exceeding the number of lymphocytes.

Histological Characteristics of the Connective Tissue Changes. In the main, the histological variations of the cirrhotic lesion do not lend themselves to classification. In the livers of 590 cases of well marked cirrhosis, Mallory found 110 (18.5 per cent) atypical cases which he could not classify. Inflammation and irregular scarring develops wherever destruction of cells occur. Variously, the inflammatory process involves portions of lobules irregularly, and even surrounds single cells or small groups. But the lobular pattern in such cases is still recognizable. Sometimes the characteristics of the Laennec type of cirrhosis is replaced by that usually seen in the biliary type.

In advanced stages there are marked disturbances of the venous circulation especially in the portal radicals. Normally, the portal and hepatic venous systems divide in an arborescent fashion and the branches from each tree interlace regularly and end in fine dendritic branches which dove-tail alternately. This is characteristic of Laennec's cirrhosis.

Occasionally, the anatomical distortion results in obstruction of the smaller ducts. In most of the livers there is more or less bile retention appearing as fairly large plugs in bile canaliculi, as very small dots of greenish inspissated bile, and collected as greenish masses around fat droplets within a liver cell. In no case has there been an extrahepatic block. The mechanism is obviously an intrahepatic cellular one, due to the intense and fairly rapid swelling of the parenchyma, and is most probably an inability to excrete bile from the hepatic cell into the bile canaliculi.

In the process of repair following repeated injury, all of the hepatic structures seem stimulated to extraordinary proliferation. The liver cells regenerate but their physiological efficiency seems less than par. There is also proliferation of the bile ducts and this sometimes approaches sizable proportions. There is interstitial activity as shown by the young fibrous and vascular tissue. Kupfer cells seem more abundant. Much of this has been shown experimentally and clinically, as indicated previously, in biopsy studies.

HYPERTROPHIC BILIARY CIRRHOSIS (HANOT)

The preceding factual summary pertains: (1) to an unclassifiable group of cases of the chronic proliferative connective tissue form of chronic hepatitis arising from a variety of known and unknown reasons and agents, in all kinds of people, and in a variety of conditions; and (2) to a demarcated clinical complex rather sharply distinguished anatomically as the atrophic (Laennec) type of cirrhosis of the liver. Both of these forms occur in older people; the first form usually, and the second form occasionally, can be produced experimentally in animals by injurious chemical agents of many kinds; and, clinically, the first form occurs as an incidental clearly recognizable reparative attempt in the presence of other differentiated lesions (parasitic disease, tuberculous and leutic infection, etc.), and the second form occurs in frequent association with chronic alcoholism. Both of these forms differ markedly, both clinically and anatomically from that rather uncommon form of cirrhosis which occurs in the young, and which is marked clinically and anatomically by enlargement of the liver with equal or more marked enlargement of the spleen and by a constant and persisting jaundice. The latter is the form usually referred to as the biliary, or hypertrophic form of, or as Hanot's cirrhosis.

Grossly, the liver is usually uniformly enlarged in this variety. The surface is finely granular, in contradistinction to the hobnail appearance of the Laennec lesion. The blood vessels and large bile ducts show no lesion; and bilirubin-calcium calculi are very rare. Gallstones are only occasionally present in the gallbladder, probably as a coincidental finding.

Microscopically, there is a delicate fibrosis surrounding the small bile ducts, some of which are obliterated and others dilated. The individual acini are no longer normally demarcated inasmuch as the further connective tissue proliferation occurs, either exclusively or to the largest extent intralobularly as opposed to the interlobular distribution in the Laennec variety. The liver cells are individually, or in small groups separated from each other by bands of fine fibrillar connective tissue which for a long time remain cellular, retain the early characteristics and do not shrink or contract. The enclosed liver cells are comparatively free from change in the early stages: later, they commonly contain pigment granules and fat, usually decrease in size, and sometimes show evidence of dissolution.

Around the periphery of the lobules there are new bile duct formations which stain brilliantly and are composed of cubical or elongated cells enclosing a potential lumen. They sometimes attain the size of, and simulate an adenomatous formation. The largest ducts are ordinarily empty and show no apparent change. The fine bile canaliculi seem filled with material; and the somewhat larger ducts are crowded with desquamated cellular and other material. Such evidences of a capillary cholangitis are commonly present. In experimental poisoning by toluylenediamin the small bile ducts become inflamed in an analogous manner, the process beginning in the biliary radicles. Experimentally, also, manganese, which is mainly excreted in the bile, gives rise to a biliary cirrhosis,[27] and Casomavor has reported a biliary cirrhosis in a fatal case of manganese poisoning in men.

The spleen is much enlarged, and may be larger than the liver. There may be perisplenic adhesions. Microscopically, there is fibrosis, distention of the sinuses with blood and endothelial proliferation of the pulp. The periportal lymph glands are enlarged and pigmented. The alimentary canal is free from inflammation.

In uncomplicated cases death is due to the gradual progression of the lesion and to a correspondingly increasing toxemia. A sudden acute degeneration of the liver cells, resembling that in acute yellow atrophy, may precipitate coma and death. Erysipelas is especially prone to attack these patients who may also succumb to other acute infections, such as pneumonia or peritonitis. The occurrence of exacerbations at shorter intervals indicates that the disease is advancing rapidly, and the incidence of complication renders the prognosis very grave. Widespread hemorrhages, edema of the legs, and ascites show that the end is approaching.

In contradistinction to the predominating toxic origin of the Laennec type of cirrhosis, it has been assumed that hypertrophic biliary cirrhosis is due to an ascending infection of the bile ducts. This has been denied by the French School because of the freedom from duodenal catarrh, the complete absence of suppuration which might be expected to supervene if this was the case, and because there is little in the way of any pancreatic infection which they believe should be present on the assumption of an ascending infection. Nevertheless, the fever and the concomitant enlargement of the spleen and sometimes of the lymphatic glands favor the causal relation of bacterial infection. According to Rolleston, the pancreas does show a fine fibrosis of the embryonic type. In any event, these objections to the infectious origin of the hypertrophic form of cirrhosis do not seem to be sufficiently conclusive.

Hypertrophic biliary cirrhosis may be closely imitated by the perilobular form of chronic interstitial hepatitis, by syphilis, by chronic splenomegalic hemolytic jaun-

dice. Considerable doubt has been, therefore, expressed as to its being a separate entity, and Oertel denies any justification for so considering it. Nevertheless, the concept that the biliary intralobular form of fibrosis has a tendency to spread outward into the interstitial septa of the liver (perilobular form of hepatitis) seems to be justified by the picture seen in a tubal nephritis or nephrosis in which the latter is eventually complicated also by interstitial connective tissue changes. Furthermore, Rous and Larimore[105] have shown that the liver changes differ according to the level of any obstruction in the biliary tract.

DIFFERENTIATION OF BILIARY CIRRHOSIS FROM CHRONIC INTERSTITIAL HEPATITIS

All available knowledge points to the conclusion that the hypertrophic biliary cirrhosis of Hanot is not a succession of episodes as in the other varieties, more particularly in the Laennec atrophic variety, and that it has no etiological relation with them; but that it is a distinctive and sharply differentiated form of disease which has little or no interludes of remission, and which is a continuous progressive form from its very beginning until its very end. The further conclusion seems inescapable that this has to do with the biliary apparatus *per se*. A distinguishing characteristic of this variety is the splitting apart of the individual hepatic cells, as if the cement substance which keeps them in their normal anatomical relationship with one another and with the bile capillaries has been destroyed or, in some way, inhibited in its action. The connective tissue production here is most probably related to this intercellular separation.

COMMENTS

In clinical practice a breakdown can occur in persons whose hepatic structure and function had previously been apparently normal, or perhaps more probably, in persons in whom some hepatic damage had already existed as a multiple incident and in whom, in between these episodes, a partial or complete anatomical and functional recovery had taken place. Sensitization of the liver because of these repeated injuries, opportunity for which is sufficiently abundant in everyday life, renders the liver increasingly susceptible to the toxic damage and helps to explain the reason why some patients go through an overpowering fulminating course to death even after the first injury while others show mild, symptoms and eventually recover or possibly show no symptoms at all. A vicious circle is sometimes so produced.

The differences in duration, and in the manner of the development of this clinical and pathological complex, in the symptoms, in the suddenness and dramatic effect of the clinical mainfestations and in the rapid culmination in death, or in the more protracted course with apparent temporary improvement but, nevertheless, slow progression to the terminal stages herinafter to be discussed, or in the repetition of mild episodes with incomplete restoration to the normal in the remission periods and the passage into the terminal picture hereinafter to be discussed, seem to have important relations to the size of the dose of the causative agent, to the number and frequency of its repetitions, to the time limit in which the latter is delivered, to any intercurrent duct obstruction, and to various forms of preceding sensitization of the body to diverse toxic bodies. When the toxicity of the causative agent is sufficiently powerful and the latter is applied with sufficient intensity, the resulting hepatic injury is sufficiently large so that immediate death can and does occur. This is illustrated clinically in the acute cases of yellow atrophy of the liver of in those dramatic fatal cases of the hepatorenal syndrome which sometimes occur in the postoperative period after lightly undertaken operations upon the gallbladder and biliary tract for comparatively simple conditions apparently devoid of any undue risk and danger. From this easily recognizable hyperfulminant form of injury and disease,

all gradations occur clinically down to those in which the evidences of disease are at a minimum and, sometimes even imperceptible to the clinician.

The initial stage of hepatitis may be clinically acute and promptly fatal. This group includes not only cases of so-called acute yellow atrophy, but also instances of a less violently destructive process which have been classified under the generic term of "toxic cirrhoses." These are, perhaps, the only cases in which a single episode of liver injury occurs and repetitions of the injury are prevented by the immediate fatal outcome.

An equally acute onset with an almost equally marked clinical symptomatology may rarely be followed by an apparently complete clinical recovery. In the usual run of case, this does not necessarily imply an equally complete anatomical healing and restoration of physiological function.

In other words, the liver damage may be so mild and ephemeral as to be unrecognizable unless one is on the lookout. In the latter cases, indications of the presence of disease are only to be found in changes of liver function or in the appearance of otherwise unexplainable jaundice. Any degree of jaundice occurring under such conditions is an indication of hepatitis even in the absence of any laboratory data.

After repeated episodes—and this repetition of episodes is undoubtedly the rule—latent anatomical changes and mild disturbances of physiology are present. The possibility of such increasing latent damage in structure or function which may gradually progress over many years until easily recognizable clinically, and until hepatic insufficiency eventually supervenes, is shown by those rare instances of cirrhosis in which a story of one or more previous episodes can be elicited. Such observations including the repetitions of these acute or subacute episodes, which, in between, subside again into latency have been clinically observed (vide supra); and such a cycle has been repeated a number of times before the patient dies. Blomfield points out the analogy between these long drawn out liver cases to the course of glomerular nephritis (Addis[2]).

Numerous experiments have shown that the liver has an extraordinary capacity for regeneration. Even after the removal of destruction of large portions of the liver, regeneration is accomplished by the formation of new lobules of normal size, shape, structure, character and vascular supply as shown by repeated biopsies and by laboratory tests of hepatic function. The architectural pattern in such regenerated livers is indistinguishable from that of a normal liver and no fibrotic changes follow.

This type of change and result usually can follow only a single relatively mild injury. It cannot and does not, however, follow a continued or repeated injury of a similar and/or, perhaps, of a dissimilar nature. Repetition, or continuation of the injury causes a chronic diffuse hepatic inflammation the essential features of which are degeneration and destruction of hepatic cells, regeneration of cells from those remaining, and subsequent attempts at repair marked by proliferation of connective tissue. Nevertheless, the conception that this is always synonymous with cirrhosis, as ordinarily understood, is somewhat erroneous even if it be so generally accepted.

It is very difficult to establish or even estimate the degree of anatomical restoration or functional recuperation either after a single or even after repeated parenchymal injury. And there is some evidence to show that in the present state of our knowledge, one may not lightly escape the thought that perhaps no complete anatomical and functional recovery ever occurs even after a single episode of injury or disease.

MECHANISM OF DISTRIBUTION OF THE PROLIFERATED CONNECTIVE TISSUE

Anatomy. There are important features in the vascular arrangement in the liver which are most pertinent to this discussion. While imperfectly understood, there is

general agreement that the portal vein and hepatic artery spread out in an intricate capillary network which is intimately related to the liver cells.

The hepatic artery ramifies through the portal canals in the fibrous capsule of Glisson, forms a plexus outside each lobule, and appears to be destined chiefly for the nutrition of the coats of the blood vessels and bile ducts.

The portal vein also runs through the portal canals enclosed in Glisson's capsule, which finally break up into a plexus, the interlobular plexus, from which the blood is carried into the lobule by fine interconnected branches which converge from the circumference to the center of the lobule, and the walls of which are incomplete so that the blood is brought into direct relationship with the liver cells. The lining endothelium consists of irregularly branched, disconnected cells (stellate cells of Kupffer). Moreover, according to Herring and Simpson, minute channels penetrate the liver cells themselves, conveying the constituents of the blood into their substance. Arrived at the center of the lobule, the sinusoids empty themselves into the central lobular vein which after uniting with other similar veins to form larger and larger trunks, ultimately empty into the vena cava.

The blood capillaries of the liver lobule differ structurally from capillaries elsewhere. Developmentally, they are formed by the growth of the columns of liver cells into large blood spaces or "sinusoids." The Danish zoologist, Krogh, who has made most extensive studies, considers that the endothelium of the hepatic capillaries is a syncytium with numerous nuclei but without defined cell borders as in the embryonal capillaries, and that the star cells of Von Kupffer, which appear at rather short, regular intervals, are an integral part of the capillary wall. The English histologist, Schafer,[108] believes that what remains of the endothelium of the liver sinuses is represented by these stellate cells.

Distribution of the Proliferated Connective Tissue. The distribution of the proliferated connective tissue can be classified as follows:

1. In atrophic (Laennec) cirrhosis, the connective tissue is arranged in bands which includes multilobular segments of liver tissue, is mostly arranged along the lines of the original lobular framework of the liver, and follows along Glisson's capsule where the arteries, veins and lymphatics are found.

2. In hypertrophic (Hanot) biliary cirrhosis, the connective tissue proliferation occurs intralobularly and seems to have no connection as to localization with the distribution of the original liver framework nor with Glisson's capsule or its contained vascular and other structures.

3. In all other varieties of chronic interstitial hepatitis the distribution of the new connective tissue is irregular and has no clear connection with any of the essential liver structures: connective tissue framework, or vascular paths indicated above.

4. Specimens occur in which the proliferated connective tissue in the same liver shows the characteristics of all the previous three groups either mixed up together in a single area or segregated apart in various scattered areas.

Path of Action of the Causal Agent. It seems correct to assume the following deductions from the above facts:

1. The characteristics described in group 1 indicate that the causal agent acts along the vascular paths of the liver. This is supported by the further fact that the connective tissue proliferation has been demonstrably seen to proceed from the walls of the sinusoids.

2. The characteristics described in group 2 indicate that the causal agent has acted along the paths of the bile capillaries between the liver cells. In no other way can one explain the separation of the individual liver cells in the liver cords by the new fibrillar connective tissue. It seems correct to postulate that the direction of action may be in either direction, i.e.,

(a) toward the liver cell, and (b) from the liver cell outward in accordance with the secretion and excretion function of the cell. Because of the bacteriolytic function of the liver, it seems that bacteriologic infection can only be a retrograde phenomenon from the alimentary canal upward into the liver and this must be the mechanism of any cholangitic origin of the Hanot type of cirrhosis. On the other hand, the experimental reproduction of this type of cirrhosis, e.g., as with phosphorus, indicates that under certain conditions the Hanot type of cirrhosis could be due to agents secreted and excreted into the bile capillaries from the vascular channels through the hepatic cell.

3. In the numerous varieties encountered in this group, the connective tissue proliferation is related to the causal agent and its path of action. Thus in the case of toxic agents, it may follow the vascular channels, especially the portal vein, (heavy metals, chloroform, alcohol, etc.); in the case of bacterial infections, it follows more particularly the hepatic artery distribution and/or the lymphatic channels; in the case of other forms of disease, it surrounds these areas closely (lues, tuberculosis, hydatid and other forms of cystic disease, etc.). Under other circumstances it follows the distribution of the areas and segments of liver parenchyma which has been destroyed by the causal agent.

4. In this group the connective tissue distribution is undoubtedly related to a mixture of causal agents and their various paths of action and distribution.

In the majority of the cases, the poisons reach the liver by the portal vein and come from the alimentary canal. In a few instances poisons, and possibly microorganisms, from the spleen reach the liver by the splenic vein, as for example (a) in splenic anemia in which hepatic cirrhosis follows and constitutes a terminal condition usually designated Banti's disease, and (b) as in Egyptian splenomegaly.[98]

Acute and Chronic Cholangitis and/or Cholangiolitis. There are important clinical and anatomical relationships between acute yellow atrophy, biliary cirrhosis (especially the Hanot type), and the subject of cholangitis. Frequently the clinical manifestations are identical and equally often the anatomical pictures are indistinguishable.

All of the inflammatory diseases of the bile ducts are characterized by ascending infection, signs of occlusion and by changes in the parenchyma of the liver. In this respect cholangitis resembles the demonstrable phenomena in similar processes in the excretory channels of other parenchymatous organs.

Primary ascending biliary infection in the non-obstructed system of ducts is not a common occurrence except when there are abnormal connections between the gallbladder and gastrointestinal tract.

Cholangitis may be defined as an inflammatory process occurring in and around the walls of the intrahepatic biliary passages. Curiously enough generalized secondary infection of the biliary passages rarely occurs from systemic infection, from metastatic hepatic abscesses, or from pyogenic granulomas involving the substance of the liver. Strictly speaking, and on an anatomical basis, there is no true cholangiolitis. In the liver lobule the bile radicles are so devoid of structure that no inflammation can be recognized. Here the visible changes concern themselves with the lining liver cords whose cells actually form the wall of the bile capillary. In any event, the inflammatory process is limited to the environment of the duct system outside of the liver lobules. The pathologic lesions vary from simple "catarrhal" involvement of the lining epithelium to periductal fibrosis and thickening of the wall of the ducts, and lymphocytic and leukocytic collections in the connective tissue surrounding the portal spaces.

None of the minor grades of infection of the biliary passages, whether acute or chronic, are associated with a definite clinical picture, or at least with one that is generally recognized. Again it seems

probable that many clinically recognizable instances of biliary infection are dependent on a low grade lighting up of a chronic infectious process in the ducts by episodes of biliary obstruction. The process is a diffuse one involving the whole liver; it consists mainly of periductal fibrosis with local collections of lymphocytes and proliferation of the terminal bile ducts.

The later stages of the more chronic types of cholangitis are largely masked by the signs of biliary obstruction. The combination of obstruction and infection of the biliary passages produces the maximal amount of injury to the hepatic parenchyma, varying with the degree and duration of obstruction and with the extent of the pre-existing, accompanying or subsequent infection. In relatively acute complete obstruction, the common duct is usually not dilated and infected. Cellular activity become so suddenly inhibited that no excretion takes place and the duct lumina remain unchanged. In intermittent obstruction, however, dilation of the intrahepatic tree follows and may become considerable. It is limited by the presence of fibrosis in the wall of the ducts as a result of previous inflammation. The most striking change observed consists of active proliferation of connective tissue in and about the smaller bile ducts.

Under certain conditions, suppuration occurs in and about the biliary passages. Active suppuration in the biliary passages most frequently represents a lighting up of previous infection in the environment of the bile radicals. Because of the previously mentioned anatomical peculiarities of the ducts, suppuration in these passages represents an extremely serious and often fatal condition. The pathologic changes observed in cases of purulent cholangitis obviously depend on the previous state of infection and upon the degree of dilation of the biliary passages and on the virulence of the infection organism. In bile passages, which are already sclerosed and dilated because of preceding duct obstruction, the process may go on to a state of chronic suppuration. The intrahepatic ducts exude foul, turbid, purulent bile which contains calculous sand. Miliary abscesses about the finer bile passages often are a striking feature. Large, solitary abscesses may be a feature in the more chronic cases.

HEPATIC LYMPHANGITIS

In all of this discussion one may not pass aside the subject of lymphangitis of the liver.

According to certain authors[15,16,25,28,56,70,118,124] the lymphatic paths of the liver originate within the hepatic lobules and according to Herring and Simpson,[49] Lee[64] and Gabrielle,[34] these pathways are intercellular spaces which do not possess an endothelial wall and do not extend beyond the interlobular area.

There is an extensive network of lymphatic vessels lying in the deep connective tissue layer of the liver capsule over the entire organ. From thence endothelial lined lymphatic vessels form a network in the connective tissue which continue into the capsule of Glisson, and around the ramifications of the portal vein, hepatic artery, and biliary ducts. The lymphatic network on the hepatic veins anastomoses with that which surrounds the branches of the portal vein.[64] These form the deep network. The superficial and deep networks in man are connected with each other by a great number of lymphatic trunks, more numerous on the inferior than on the posterosuperior surface of the liver (Baum) and are particularly numerous in the vicinity of the free anterior border of the organ.

The distribution of lymphatic channels around the grouping of portal and hepatic vascular radicals and around the biliary tree is very suggestive. The importance of lymphangitic involvement in all forms of liver infection cannot be overestimated and has hitherto not been sufficiently emphasized. In cholangitis, the process seems to be associated with lymphatic infection and it may be that the term "ascending infection from the intestinal tract" is in reality an ascending infection

along the lymphatic channels. The occurrence of multiple small foci of suppuration in the liver parallells rather well similar small foci of infection that occur along the lymphatic channels in similar infections of an arm; and the subsequent periductal fibrosis would represent the healing stage of the lymphatic infection.

In toxic injury of the liver parenchyma secondary infections of very low grade undoubtedly supervene at some time in the biological development of the effects of the injury. It is most suggestive that the bands of fibrous tissue should follow along the ramifications of the contents of Glisson's capsule. Here, too, one may not lightly dismiss the rôle and importance of a low grade bacterial lymphatic infection.

Hepatic lymphangitis is, so to speak, the point of contact between biliary cirrhosis and cholangitis. Inasmuch as both of these clinically differentiated conditions eventually, if continued long enough, terminate in similar pictures of an intralobular form of cirrhosis, the point of contact is, most probably, the point of origin also.

Hepatic lymphangitis is also, so to speak the point of contact between acute, yellow atrophy and hyperacute forms of cholangitis. Very frequently, the clinical picture and the postmortem anatomical findings are indistinguishable. One may not escape the thought that a lymphangitis is an important factor in both of these clinically differentiated conditions.

Finally, one often speaks and hears of the difficulties of adequately draining an infected biliary tree. Nevertheless, this should be fairly easily accomplished inasmuch as the normal function is drainage. Again, one may not escape the thought that the difficulty in adequate drainage does not lie in the biliary tree, but in the surrounding lymphatic channels. These, indeed, are impossible to drain by any surgical means.

Many years ago, it was attempted to influence favorably the lesions of a Hanot type of hypertrophic biliary cirrhosis by a prolonged drainage of the biliary tree through the common duct. Drainage was always relatively free, but nevertheless, the condition did not better but became progressively worse. Again, one may not escape the thought that the anatomical area which it was necessary to drain, could not be reached through the common duct because it lay in the lymphatic channels.

SURGICAL CONSIDERATIONS

Degree of Hepatic Damage. In practical surgery, the importance of all of this lies in the extent of functional damage which all of this anatomical change brings about.

The degree of hepatic damage shown varies a good deal, while in general the anatomic changes are more or less proportional to the amount of hepatic damage. The amount of reserve which is left, from which one may attempt to determine the prognosis, is not usually apparent, demonstrable or measureable.

The best and most competent idea of hepatic damage must still be based on more or less purely clinical grounds. The many chemical and biological tests which have been proposed for the study of hepatic damage are bound up with tests of hepatic function. Dye excretion tests of many sorts and chemical tests based on metabolic change have been tried out and found not entirely satisfactory. In most cases hepatic function is demonstrably maintained by compensatory effort, as bile is still present in the stool, since there is no impairment in glycogenesis or any evidence of failure to deamidize the amino acids, in that urea formation is unhampered and a progressive increase of nitrogenous products in the blood is not observed. Nor is there present in the early cases the clinical picture of well established disease, marked by abdominal distention, vomiting, rise in temperature, oliguria, appearance of albumin, casts and red cells in the urine, increase of residual nitrogen in the blood, bleeding into the mucous surfaces, blood in the vomitus and the stool, and ascites or enlargement of the spleen.

A much greater degree of invisible pathologic change exists when jaundice appears.

The change is always physicochemical and indicates severe changes and a state of emergency. When superimposed on any of the demonstrable changes mentioned in the preceding paragraph, it indicates a long standing, perhaps usually an irreversible, pathologic condition. In many cases it indicates a terminal stage of the illness, and in any case a lack of hepatic reserve approaching the absolute.

INTERFERENCE WITH PROTEIN METABOLISM

The hypoprotinemia which accompanies chronic interstitial hepatitis is a most important item in the make-up of any of the advanced forms of disease. Just how much of a factor it is in the earlier stages of the disease has not been sufficiently established although there is reason to believe that some of it already is present.

The available facts regarding the relationship of the liver to the protein metabolism indicates that the central site of formation of the plasma proteins is the liver. The proofs of this are best established in regard to the plasma fibrinogen, and the liver is the sole site of formation for albumin. Most of the globulins are most probably formed in the liver, although there may be other sites for this also. The replacement of plasma proteins takes place from two sources, the ingested food intake and the reserve store of protein material.

After the amino acids reach the liver from the intestinal tract, they are built into proteins but a portion of this synthetized material is placed in the reserve store of plasma material, which is kept mainly in the liver.

Davis and Getzoff[22] distinguish the following varieties of hypoprotinemia: (1) Concomitantly with the insufficient nourishment, i.e., inanition which is apparent in the advanced case, there is a "prehepatic" form of hypoprotinemia due to the lack of supplied food. (2) As the function of the liver deteriorates, there is interference with the ability to synthetize plasma proteins, an "hepatic" form of hypoprotinemia. Infection seems to be an important item in this interference. (3) Should a loss of fully formed plasma protein occur from the body the third, or "post-hepatic" form of hypoprotinemia occurs.

With these facts in view two conclusions seem inevitable: (1) All cases of gallbladder and biliary tract disease, especially when operation is contemplated should be investigated as to the presence of any hypoprotinemia and, if found, the deficiency should be corrected; and (2) estimations of the hypoprotinemia might form a very accurate method of determining the function of the liver either alone or in combination with other tests. If the deficiency, i.e., the hypoprotinemia, should be uncorrectible, it undoubtedly would indicate an advanced disease, and/or an irreversible liver damage with loss of hepatic function and the gravest of prognoses.

As a corollary to all of this, Gyorgy and Goldblatt[40,41] point out that a sufficient protein content in the diet is important in the prevention of any deficiency of vitamin B (unidentified factor) and that the vitamin deficiency itself has caused, experimentally, an acute focal or diffuse hepatic parenchymal necrosis with an occasional diffuse periportal fibrosis. The importance of sufficient available vitamin B is therefore further emphasized.

As a further corollary to this, the impor tance of a luxury protein diet for the maintenance of adequate "anti-body matrix" (protein reserves) to serve as basic materials for specific antibody templation is in line with statistical evidence covering the increased susceptibility to infectious diseases observed as a result of dietary insufficiency.[17,26,68] The accumulated evidence emphasizes the importance of a "luxury" protein intake as a bulwark against infection (Madden and Whipple).

INTERFERENCE WITH BLOOD CLOTTING FUNCTION

In the presence of sufficient hepatic cell damage, the normal blood clotting function becomes disturbed. The abnormality is

most marked when the subject has been jaundiced for some time, and, up to the present writing, this clinical fact has been the most expressive warning of the potential danger of postoperative hemorrhage. When there is reason to suspect before operation that there is previously existing hepatic cell injury and destruction, the blood clotting function should be thoroughly investigated by the available laboratory means, even in the absence of any jaundice and, especially so, when jaundice is present; when found deficient, adequate preparation with vitamin K, etc., should be carried out.

RENAL COMPLICATIONS (HEPATORENAL SYNDROME)

Degree of Renal Damage. Commonly such a complex condition is sooner or later associated with secondary renal changes (hepatorenal syndrome). It is impossible to say to what stage the hepatic disturbance must progress before clinical evidence of renal involvement can be obtained by functional tests, which, up to the present writing, are notoriously unsatisfactory.

Value of Renal Changes as a Measure of Hepatic Dysfunction. However, as I have pointed out, the renal mechanism furnishes a satisfactory means of detecting any preceding change in the liver; any significant change in the kidney could, therefore, in properly selected cases be employed, other things being equal, as a measure of any otherwise unrecognizable disturbance in the liver. This is the value of tests of renal function in the presence of liver disease.

When the manifestations of this syndrome appear, one must assume that they represent a continuation of the preceding functional and anatomic pathologic process. The development of the picture is rather slow, although usually, as complete dissolution approaches, an apparent hastening of the process and a more rapid development seem to take place. When the alarming symptoms appear after an operation, it is probable that a measure of bacterial infection has been introduced, which, superimposed on whatever else has preceded, becomes "the straw which breaks the camel's back."

Once this train of functional and anatomic disturbances begins, other factors come in to play, such as fever, shock, autolysis of tissue, anoxemia, anhydremia and azotemia. All of these aid and abet the primary agents or even each other, by producing conditions which are capable of creating, or are found associated with, similar cellular degenerations in these parenchymatous organs. As must be apparent, the amount of overlapping in the various manifestations of all the conditions discussed is enormous. A vicious circle, therefore, is produced, and the primary injury is enormously accentuated.

RELATION OF LATENT HEPATIC DISEASE TO THE PROGNOSIS IN PRACTICAL SURGERY

In practical surgery, usually the unexpected changes observed during operation indicate a fairly advanced stage of the previously existing disease. Nevertheless, recovery can occur from the immediate form of illness and from the prevention of any postoperative hemorrhage, in the employment of a different form of anesthesia, or in a change in the usual operative technic or procedure, which might help to obviate or lessen the immediate effects of the operative trauma, or the occurrence or effects of any resultant postoperative complication or event.

Practically speaking, the most important precautionary measure which is available is encompassed under the general provision of an improvement in the general nutrition. An abundant supply of carbohydrate must be combined with an adequate supply of protein. The latter is especially important in order to counteract the hypoprotinemia which is present. For the latter purpose transfusion of whole blood or of plasma, or the enteral or parenteral use of any of the various animoid preparations, in addition to adequate protein intake in the diet are neces-

sary. From the latest available studies it seems that an adequate supply of vitamin B is also most essential.

SUMMARY

Operation upon the gallbladder and biliary tract is sometimes disturbed by encountering evidences of previous disease of the liver usually some form of chronic productive interstitial fibrosis. The surgeon must then be able to present to the patient the causal connection of this preceding change and the immediate and ultimate outcome to be expected.

Many causes contribute to the appearances of these changes and usually a combination of agents are present. They function by interfering with the nutrition of the hepatic cell, cause degenerations and necroses of the liver cell, and are followed by connective tissue changes taking the form of a perilobular fibrosis or less often by an intralobular disruption of the liver cords and an intralobular fibrosis. Nevertheless, recovery can occur from the immediate form of illness and from any operative insult. It should, however, endow us with caution in making any prognostic statement as it does not preclude recrudescences of injury with further advance of the process to an irreversible stage. In addition, it must be understood that the interstitial fibrosis itself may be productive of secondary effects as bad, if not worse, than the original injury. But in any event it must be understood that the chances are more than good that there will be further symptoms and that the patient will not be entirely well; and that there may be further serious disease eventually culminating fatally.

On the other hand, when the evidences of previous disease are so demonstrable, unexpected and frequently serious and even fatal events follow in the immediate postoperative period, or even shortly thereafter, after the discharge of the patient from the hospital, which is only understandable because of the preceding liver injury and damage.

In some instances it is possible to suspect before operation that previous liver injury had taken place as a consequence of which there are interstitial changes in the liver. When these are suspected and, possibly, corroborated by some of the tests of liver function, it becomes necessary to revise any previously held opinion regarding the risks of operation. The suspected changes might very well form serious objection to the performance of any operation of an elective nature. And in compulsory operations they might indicate a greater effort in the exercise of precautionary preoperative measures.

Some degree of hepatitis always appears. Commonly, it is difficult to establish the point at which these changes are recognizable clinically. The forms of acute yellow atrophy are the maximum ultimate manifestations to which all of these changes may lead. In between there are all gradations down to the most minor.

The initial hepatic injury may be immediately fatal, or recovery may take place with restoration of anatomical form and functional effort. Usually, however, there are repeated episodes. The more or less complete and/or successful attempts at restoration to the normal after the first injury become progressively less effective after subsequent and repeated injuries. Latent anatomical changes and disturbances of physiology, therefore, take place which sometimes are capable of being shown by tests of liver function; or they are called to one's attention by various grades of otherwise unexplainable jaundice. All of this has important relations to the character and size of the offending agent and to the frequency and number of the repetitions of these episodes.

To the surgeon, the importance of all of this lies in the amount of liver damage which is present. At the present writing, the best idea of this is based to the greater extent on purely clinical evidence. Latterly, the degree of hypoprotinemia and the degree of any interference with the blood clotting function have added some labora-

tory criteria to aid in this effort. And when, as is always the case, sooner or later, secondary renal changes occur, the demonstrable changes in renal function may be used as clinical indications of the amount of liver damage.

In practical surgery such unexpected operative discoveries indicate usually rather far advanced disease. Nevertheless, recovery from operation may occur; but it must be understood, that further trouble is bound to occur and that the patient will not be well; or unexpected and frequently fatal events may follow operation, the explanation of which lies in the preceding liver disease.

In some exceptional instances, it is possible to suspect before operation that such liver injury had already taken place; and when these are suspected, it may be possible to corroborate them by various tests. It then becomes necessary to revise any previously held opinion regarding the risks of the proposed operation. The suspected changes may very well form serious objections to the performance of any operation of an elective nature. And in compulsory operations, they would demand greater effort and care in the exercise of precautionary measures for the prevention of postoperative hemorrhage, in the selection of the anesthetic to be employed, or in the formulation of a different plan of operative procedure, in order to obviate or lessen any subsequent untoward postoperative event and/or manifestations. Of the precautionary measures, an adequate supply of carbohydrate, an abundant supply of protein—in the food, by transfusions of whole blood, or plasma, and by the use of aminoids—to counteract the usual state of inanition (hypoprotinemia), and the use of abundant supplies of vitamin B, are most essential.

REFERENCES

1. Abramson, L. Hepatitis chronica in younger persons. *Acta med. Scandinav.* 108: 561, 1941.
2. Addis, T. *Bull. Johns Hopkins Hosp.*, 49: 203, 1931.
3. Albot, G. *Ann. d'anat path.*, 8: 435, 1931.
4. Andrianoff, N. and Ansbacher, S. *Deutsche med. Wchnschr.*, 56: 357, 1930.
5. Asmann, Von H. *Müncben. med. Wchnschr.*, 78: 221, 1931.
6. Baens, Alfredo and Espinola, Noe. *J. Philippine Island M. A.*, 17: 679, 1937.
7. Barcroft, Joseph. The Respiratory Function of the Blood. Part 1. Lessons From High Altitudes. Cambridge, 1925. University Press.
8. Beaver, D. C. and Pemberton, J. *Ann. Int. Med.*, 7: 687, 1933.
9. Best, T. H. Liver necrosis following burns; simulating the lesions of yellow fever. *J. Path. & Bact.*, 48: 493, 1939.
10. Bischoff, M. *Ztschr. f. exper. Path. u. Therap.*, 11: 445, 1912.
11. Bloomfield, Arthur L. The natural history of chronic hepatitis (cirrhosis of the liver). *Am. J. Med. Sc.*, 195: 429, 1938.
12. Boix, M. *Arch. gen. de med.*, 11: 210, 1899.
13. Bollman, Jesse L. and Mann, Frank C. Alterations in hepatic function produced by experimental hepatic lesions.
14. Bortin, A. *M. J. & Rec.*, 132: 228, 1930.
15. Brissaud, E. Le Reseau d'origine des lymphatiques du foie. *Progrès méd.*, 37: 465–469, 1909.
16. Budge. Neue Mittheilungen ueber die Lymphgefaesse der Leber. *Ber. d. Koenigle, Saechsischen Ges. d. Wissensch.*, 28: 161, 1875.
17. Cannon, Paul R. *J. Immunol.*, 44: 107, 1942.
18. Carrieu, M. and Anglada, J. *Arch de méd. exper. et d'anat. path.*, 25: 149, 1913.
19. Choisser, R. M. and Wilson, P. *U. S. Nav. M. Bull.*, 26: 354, 1928.
20. Connor, Charles L. Fatty infiltration of the liver and the development of cirrhosis in diabetes and chronic alcoholism. *Am. J. Path.*, 14: 347, 1938.
21. Coope, R. and Mottram, F. H. Fatty acid metabolism in the liver. Fatty acid infiltration of the liver during pregnancy and lactation. *J. Physiol.*, 49: 23–33, 1914.
22. Davis, Harry and Getzoff, Paul L. Hypoprotinemia in surgical disease. *Arch. Surg.*, 44: 1071, 1942.
23. De Josselin De Jong. *Compt. rend. prem. conf. internat. de path. geog.*, p. 38, 1931.
24. Dible, J. Henry and Libman, Julius. Further observation of fat mobilization on starvation. *J. Path. & Bact.*, 38: 269–284, 1934.
25. Disse, J. Ueber die Lymphbahnen der Saeugethier. *Arch. f. mikrosk. anat.* 36: 203–222, 1890.
26. Elman, Robert and Heifitz, C. J. *J. Exper. Med.*, 73: 417, 1941.
27. Findlay, G. M. *Brit. J. Exper. Path.*, 5: 92, 1924.
28. Fleischl, E. Von der Lymphe und den Lymphgefaessen der Leber. *Arb. a. d. physiol. anstalt zu Leipzeig*, 4: 24–37.
29. Flinn, F. B. and Von Glahn, W. C. *J. Exper. Med.*, 49: 5, 1929.
30. Ford, W. W. *Am. J. Med. Sc.*, 131: 60, 1901.
31. Fox, Herbert. Cirrhosis of the liver in wild animals. *New York M. J.*, December 19, 1914.
32. Frerichs, F. Clinical treatise on diseases of the liver. *New Seydenham Soc. London*, 1: 223, 1860.
33. Friedewald, William F. The acute alcoholic. *J. Missouri M. A.*, 34: 410–412, 1937.

34. Gabrielle, H. Le Canal Thoracique Etude Anatomique et Experimentale. Imprimerie de Trevoces. G. Patissier, 1925.
35. Gagliardi, C. Experimental studies on the relationship between hepatitis on cholecystitis. *Chin. Cher.*, 11: 83, 1935.
36. Goodhardt and Jolliffe. *J. A. M. A.*, 110: 414, 1938.
37. Goldschmidt, S., Ravdin, J. S. and Lucke, Baldwin. Anesthesia and liver damage. I. The protective action of oxygen against the necrotizing effect of certain anesthetics on the liver. *J. Pharmacol. & Exper. Therap.*, 57: 1–14, 1937.
38. Grover, A. L. *J. A. M. A.*, 61: 458, 1913; *Arch. Int. Med.*, 17: 193, 1916.
39. Gye, W. E. and Purdy, W. *Brit. J. Exper. Path.*, 5: 238, 1924.
40. Gyorgy, Paul and Goldblatt, Harry. *J. Exper. Med.*, 75: 355, 1942.
41. Gyorgy, Paul and Goldblatt, Harry. *J. Exper. Med.*, 70: 185, 1939.
42. Haban, G. *Beitr. z. path. Anat.*, 92: 88, 1933.
43. Hall, E. M. and Butt, E. M. *Arch. Path.*, 6: 1, 1928.
44. Hall, E. M. and MacKay, E. M. *Am. J. Path.*, 7: 327, 343, 1931.
45. Hall, E. M. and Morgan, Wendell, A. *Arch. Path.*, 27: 672, 1939.
46. Handovsky, H., Schultz, H. and Staemmler, M. *Arch. Exper. Path. u. Pharm.*, 110: 265, 1925–1926.
47. Heitzmann, O. *Arch. f. Dermat. u. Syph.*, 152: 344, 1926.
48. Herkel, W. *Beitr. z. path. Anat. u. z. allg. Path.*, 85: 513, 1930.
49. Herring, P. and Simpson, S. On the relations of the liver cells to the blood vessels and lymphatics. *Proc. Roy. Soc. London*, 178: 455–596, 1906.
50. Higgens, Harold L. Effect of alcohol on the respiration and the gaseous metabolism in man. *J. Pharmacol. & Exper. Therap.*, 9: 441–472, 1917.
51. Himwich, H. E., Nahum, L. H., Rakietin, Nathan, Tazikas, J. F., Du Bois, Delafield, and Gildea, E. F. The metabolism of alcohol. *J. A. M. A.*, 100: 657–664, 1933.
52. Huguenin, R., Neumours, August, and Albot, G. *Ann. d'anat. path.*, 9: 263, 1932.
53. Hurst, E. W. and Hurst, P. E. *J. Path. & Bact.*, 31: 303, 1928.
54. Isobe, K. *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 27: 750–761.
55. Kalkus, J. W., Tripper, H. A. and Fuller, F. R. Enzootic hepatic cirrhosis of horses (walking disease) in the Pacific Northwest. *J. A. M. A.*, 21: 285–296, 1925.
56. Kisseleu, J. Ueber die Lymphgefaesse der Leber. *Centralbl. f. d. med. Wissensch.*, 8: 147–148, 1869.
57. Krarup, N. B. and Roholm, K. Development of cirrhosis of liver after acute hepatitis. Illuminated by aspiration biopsy. *Nord. med.*, 10: 199, 1941.
58. Kryle, J. and Schopper, K. J. *Virchows arch.*, 215: 309, 1914.
59. Kuczyski, M. H. *Beitr. z. path. Anat. u. z. allg. Path.*, 65: 315, 1919.
60. Lamson, Paul De and Wing, Raymond. Early cirrhosis of the liver produced in dogs by carbon tetrachloride. *J. Pharmacol. & Exper. Therap.*, 29: 191–202, 1926.
61. Lanceraux, E. *Bull. Acad. de méd., Paris*, 1897.
62. Lattes, Leone. Über den Fettgehalt des Blutes des Hundes unter normalen und unter verschiedenen experimentellen Verhaltnissen (Verdauung, Hungern, Phosphorphloridzin und Chloroformvergiftung). *Arch f. exper. Path. u. Pharmakol.*, 66: 132–142, 1911.
63. Leathes, J. B. and Raper, H. S. The Fats. P. 164. London, 1925. Longmans, Green and Co.
64. Lee, F. C. On the lymph vessels of the liver. Contrib. to embryology. *Carnegie Inst. Wash.*, 15: 65–71, 1923.
65. Letulle, M. *Bull. Acad. de. med.*, Paris, 80: 209, 1918.
66. Lissauer, M. *Deutsche med. Wchnschr.*, 39: 18, 1913; *Klin. Wchnschr.*, 51: 114, 159, 1914; *Virchows Arch.*, 217: 56–62, 1914.
67. Litten. Klinische Beobachtungen uber dic biliare form der Lebercirrhose. *Charity Ann.* 1878.
68. Luck, J. M. *J. Biol. Chem.*, 115: 491, 1936.
69. MacBride, Cyril M., Castrodale, Dante, Helwig, Elson and Bierbaum, Olga. Hepatic changes produced by estrone, estrodiol and diethylstelbestrol. *J. A. M. A.*, 118: pp. 1154, 1923, 1942.
70. MacGillavry. Zur Anatomie der Leber. *Sitzungsb. d. akad. d. Wiss., Wien.* 13: 50, 2: 207.
71. Marine, D. and Lenhart, E. H. *Arch. Int. Med.*, 8: 265, 1911.
72. Mallory, F. Hemochromatosis and chronic poisoning with copper. *Arch. Int. Med.*, 37: 336, 1926.
73. Mallory, F. B. *Am. J. Path.*, 11: 117, 1926; 7: 570–571, 1931; 9: 557, 1933; *Arch. Int. Med.*, 37, 336, 1926.
74. Mallory, F. B., Parker, F. and Nye, Robert N. *J. Med. Res.*, 42: 461, 1921.
75. Mallory, F. B. and Parker, F. *Am. J. Path.*, 7: 351, 1931.
76. Mallory, F. B. Phosphorus and alcoholic cirrhosis. *Am. J. Path.*, 9: 557–568, 1933.
77. Mangelsdorf, J. *Deutsche Arch f. klin. Med.*, 31: 522, 1882.
78. Martin, J. F. *Ann. de méd.*, 21: 89–143, 1927.
79. McDonald, S. *Brit. J. Ven. Dis.*, 8: 263, 1932.
80. McDonald, S. and Milne, L. S. *J. Path. & Bact.*, 14: 161, 1909.
81. McFarland, R. A. and Barach, A. L. The relationship between alcoholic intoxication and anoxemia. *Am. J. Med. Sc.*, 192: 186, 1937.
82. McMaster, P. D. and Rous, P. *Proc. Nat. Acad. Sc.*, 9: 19, 1923.
83. McNee, J. W. Croonian lecture. *Brit. M. J.*, 1: 1111–1116, 1932.
84. Metchinkoff. Quoted by Rolleston in Oxford Medium.
85. Meyer, E. and Heubner, W. *Biochem. Ztschr.*, 206: 212, 1929.
86. Miller, J. L. *J. A. M. A.*, 76: 1646, 1921.

87. Nathan-Larrier, L. *Bull. Acad. de méd.*, 79: 402, Paris, 1918.
88. Ogata, S. J. *Med. Res.*, 40: 103–122, 1919–1920.
89. O'Leary, P. A., Snell, A. M. and Baninck, E. G. *J. A. M. A.*, 90: 1856, 1928.
90. Opei, E. L. *J. Med. Res.*, 12: 147, 1904; *J. Exper. Med.*, 12: 367, 1910.
91. Oshima, F. and Siebert, P. *Beitr. z. path. Anat. u. z. allg. Path.*, 84: 106, 1930.
92. Patak. *Proc. Soc. Exper. Biol & Med.*, 37: 329, 1937.
93. Peters, John P. and Van Slyke, Donald D. Quantitative Clinical Chemistry. Baltimore, 1931. Williams & Wilkins.
94. Polson, C. J. *Brit. J. Exper. Path.*, 10: 241, 1929; 14: 73, 1933; *J. Path. & Bact.*, 34: 5, 1931.
95. Quastel, J. H. Biochemistry and mental disorders. *Lancet*, 2: 1417–1419, 1932.
96. Raab, W. and Terplan, C. *Med. Klin.*, 19: 1154, 1923.
97. Rao, P. K. *Beitr. z. path. Anat.*, 87: 599, 1931.
98. Richards, O. and Day, H. B. *Tr. Soc. Trop. Med. & Hyg.*, 5: 333, 1911–1912.
99. Rokitansky. Cited in Pratt and Stengel.
100. Rolleston, Sir Humphrey. Oxford Med., N. Y., Oxford Univ. Press, 19, Vol. 3, pp. 388.
101. Rolleston, Sir Humphrey and McNee, J. Wm. Diseases of the Liver, Gall Bladder and Bile Ducts. P. 215. London, 1929. McMillan.
102. Romano. *Am. J. Med. Sc.*, 194: 645, 1937.
103. Rössle, R. Hdbch d. spez. path. anat. u. hist. By F. Henke and O. Lubarsch. 5: 489–505, Berlin, 1930. Springer.
104. Rössle, R. *Virchows Arch.*, 291: 1–46, 1933.
105. Rous, P. and Larimore, L. D. *J. Exper. Med.*, 32: 249, 1920
106. Ruge, Paul. Werkung des Alkohols auf den Thierischen Organismus. *Virchows Arch. f. path. Anat.*, 49: 252–266, 1870.
107. Saltykow, S. *Verhandl. d. deutsch. path. Gesellsch.*, 14: 228, 1910.
108. Schafir, M. *Virchows Arch.*, 213: 41, 1913.
109. Schindel, L. *Beitr. z. path. Anat.*, 87: 768, 1913.
110. Scott, E. and Hulz, M. K. *Am. J. Hyg.*, 16: 865, 1932.
111. Sheehan, H. L. The pathology of acute yellow atrophy and delayed chloroform poisoning. *J. Obst. & Gynaec., Brit. Emp.*, 47: 49, 1940.
112. Silberglut, H. and Fockler. *Ztschr. f. klin. Med.*, 88: 333, 1919.
113. Smetana, Hans. *Arch. Path.*, 15: 175, 330, 516, 1933.
114. Stander, H. J. Williams' Obstetrics. 7th ed., p. 722, New York, 1936. D. Appleton Century Co.
115. Stevenson, T. H. *Practitioner*, 113: 270, 1924.
116. Sollman, T. H. Manual of Pharmacology. Philadelphia, 1926. Saunders.
117. Symmers, D. *J. A. M. A.*, 67: 315, 1916.
118. Teichmann, L. Das Saugadersystem vom anatomeschen Standpunkt. Leipzeig.
119. Thompson, Beneke and Lavenson. Quoted in Oxford Med., vol. 111, part 1, p. 390.
120. Van der Schuerer, G. *Compt. rend. Soc. de biol.*, 109: 982, 1932.
121. Van Heukelom, S. *Beitr. path. Anat. u. allg. Path.*, 20: 221, 1896.
122. Van Wulfften Palthe, P. M. Über Alkoholvergiftung. *Deutsche Ztschr. f. Nervenh.*, 92: 79–100, 1926.
123. Villaret, M., Bertraud, I., Justin-Besancon, L. and Even, R. *Ann. de med.*, 31: 334, 1932.
124. Von Wittich. Ueber die Lymphbahnen in der Leber. *Centralbl. f. d. med. Wissensch.*, 12: 914–915, 1874.
125. Weller, C. V. *Tr. Ass. Am Phy.*, 45: 71, 1930.
126. Wells, D. B., Humphrey, H. D. and Coll, J. J. The relation of tannic acid to the liver necrosis occurring in burns. *New England J. Med.*, 226: 829, 1942.
127. Whiteacre, F. E. and Fang, L. V. *J. A. M. A.*, 118: 1358, 1942.
128. Wilson, J. D. and Goodpasture, E. W. Yellow atrophy of the liver, acute, subacute, and healed. *Arch. Int. Med.*, 40: 377, 1927.
129. Yenikomshian, H. A. Cirrhosis of the liver in Syria and Lebanon. *J. A. M. A.*, September, 1934.
130. Y. Valle, Carmona M. *Gaz. Hebd. de. med.*, 2: 873, 1897.
131. Quoted by Moon. Experimental cirrhosis in relation to human cirrhosis. *Arch. Path.*, 18: 381, 1934.
132. Segers, A. *Semaine med.*, 11: 448, 1891.
133. Quoted by Best.[9]
134. Willmot and Robertson. *South African Med. Rec.*, 18: 346, 1920.
135. Rogers, L. *Brit. M. J.*, 1: 346, 1922.
136. Pirie, J. H. *M. J. South Africa*, 17: 87, 1921.
137. Oxford Medicine. Vol. 3, p. 390.
138. Whiteacre and Fang.[127]
139. Sheehan.[111]
140. Pratt, Joseph H. and Stengel, Alfred. Toxic cirrhosis resulting from acute yellow atrophy. *Am. J. Med. Sc.*, January, 1927.
141. Strumpell. *Deutsche med. Wchnschr.*, 47: 1219, 1921.
142. Seyfarth, C. Zur pathologischen Anatomie der akuten Leberatrophie. *Deutsche med. Wchnschr.*, 47: 1222, 1921.
143. Brütt, H. Zur Frage der Spontanheilung der Leberatrophie. *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 36: 29, 1923.
144. Clermont, D. Lymphatiques des voies biliaires. These de Toulouse, 1909.
145. Sudler. Quoted by Rouviere. Anatomy of Human Lymphatic System. Ann Arbor, Mich., 1938. Edwards Bros., Inc.

CRYPTORCHIDISM

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CRYPTORCHIDISM is the term applied to a condition in which the testis does not enter the scrotum, owing to maldevelopment, anatomic abnormalities or other causation. There is as great a divergence of theories regarding the normal descent of the gonad, as there is of its non-descent or tardy descent.

It appears fairly well established that the embryonic testis begins its migration from the lumbar region to the iliac fossa during the third month of intrauterine life. During the fourth to the seventh month it remains at the site of the annulus inguinalis profundus and during the seventh month it passes through the inguinal canal. The eighth month finds it at the annulus inguinalis superficialis and in the ninth month, at or after birth, it comes to rest in its final bed—the scrotum. (Figs. 1, 2, 3, 4, 5, 6 and 7.)

Theories. Many theories seek to explain the rôle of the gubernaculum testis in testicular migration. The concensus among embryologists is that the gubernaculum, a fibromuscular band, is attached to the lower end of the epididymis above and to the scrotum at its nether extremity. It is maintained, therefore, that the descent of the testicle is due to contraction or atrophy of the gubernacular musculature. According to Lockwood, the gubernaculum terminates in five tails, the strongest of which determines the transit of the testis. Either it is drawn normally to the base of the scrotum or abnormally to one of four other sites, namely, (1) the region of the inguinal ligament directly medial to the anterior superior iliac spine, (2) the anterior aspect of the pubis, (3) the femoral or Scarpa's triangle, or (4) the perineum beneath Colles' fascia. (Fig. 4.)

Certain facts are frequently presented in contradiction to this theory. A pertinent fact usually ignored, and of transcendent importance, is that the gubernacular fixation is not to the scrotum proper, but to the lower portion of the processus vaginalis and the circumjacent fascial layer. Vanverts was, therefore, among the first to maintain that the gubernaculum is inactive in the descent of the testis. Furthermore, in the newlyborn child the testis, as shown by R. H. Hunter, can be drawn out of the scrotum and into the inguinal canal without pulling the scrotum along. Without fulcrumage it is inconceivable that the gubernaculum can exert traction on the testis. It was demonstrated by Burdach that testicular descent in a normal child occurs before the gubernacular muscle fibers are in evidence.

The recent amazing development of endocrinology in one regard has served apparently to explain the rôle of the glands of internal secretion in the descent of the testicle and the causation of cryptorchidism.

Classification. Cryptorchid patients may be placed in two categories, those with incompletely descended testes and those with ectopic testes. In the first the gonad may be found arrested at any stage in its normal descent, that is, at any level from the lumbar region to the upper portion of the scrotum. Why the testis completes its migration or does not is still unsolved. John Hunter held that the undescended testis was an imperfect organ and, therefore, did not migrate in a normal manner. Many investigators maintained, with Hunter, that a normal testis, if it did not meet anatomic barriers, would always reach its normal habitat in the scrotum. This belief appeared to be supported by the fact that the incompletely

descended testis is usually small and its tubules poorly developed.

Opposed to this view are the data on undescended testes furnished many years ago by Sir Astley Cooper. He showed that the farther the pre-adolescent testis descends in its normal route, the more closely does it correspond histologically to the scrotal gland of the same age. This would indicate that the undescended testis is normal in structure, but not fully developed. Carl Moore proved that the scrotal low temperature is an absolute requirement for the complete development of spermiogenesis. The maldevelopment of the testis consequently would be the result and not the cause of its maldescent. In contradiction to Hunter's view is the added fact that until puberty, the cells of the cryptic gland retain their healthy pre-adolescent characteristics, even though the actual amount of parenchyma is reduced, which degenerative changes may begin after puberty.

Etiology. According to recent endocrinologic investigations incomplete descent may be due to one or more of the following causes: (1) Hypopituitarism, producing, as the term denotes, insufficient anterior pituitary gonadotropic stimulation of the testis; (2) primary hypogonadism, resulting in insufficient reaction to pituitary stimulation; (3) hypothyroidism, due to failure of primary tissue differentiation and lack of testicular response.

The gratifying results of hormone treatment of incompletely descended testes obtained by any physician confirm the belief that testicular function is under control of the endocrine system. (Fig. 8.)

In contrast to this type of cryptorchidism, the ectopic testis has a normal endocrine stimulus, but is arrested or

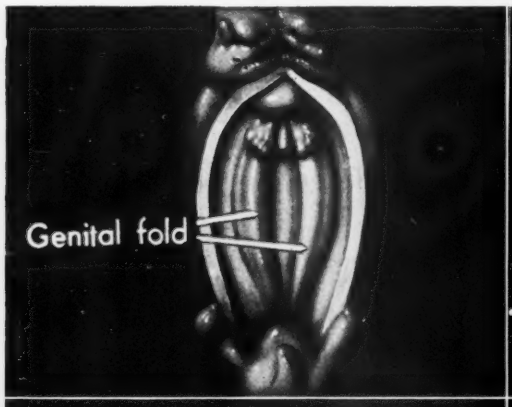

Fig. 1.

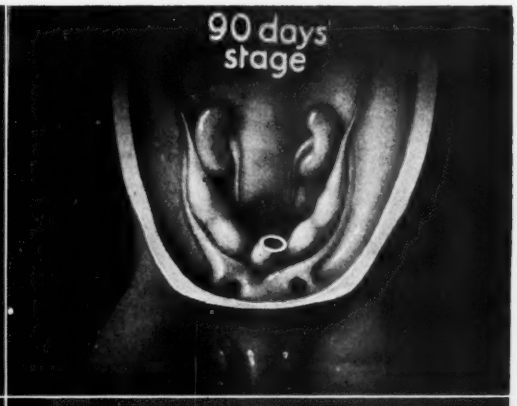

Fig. 2.

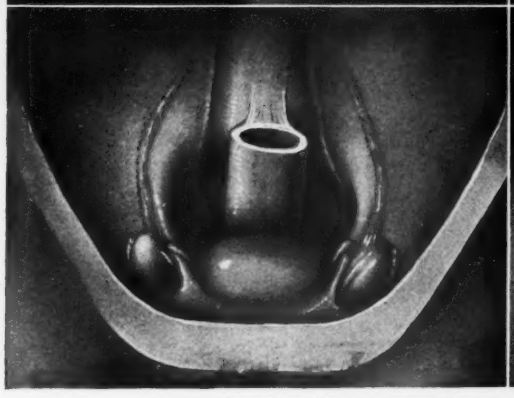

Fig. 3.

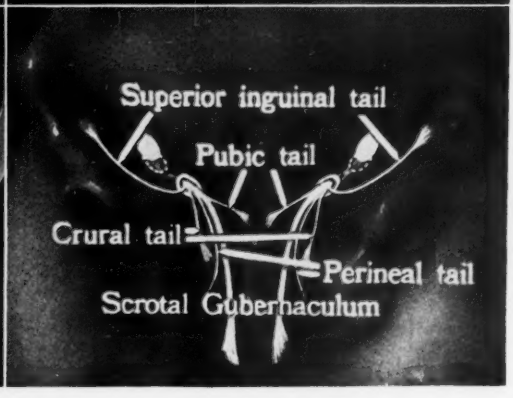

Fig. 4.

Fig. 1. Condensation of mesoderm, future testes.
Fig. 2. Testes prior to assumption of globular form.
Fig. 3. Testes at the deep inguinal rings.
Fig. 4. Various gubernacula which presumably guide descent of testes.

"detoured" by purely mechanical factors and is, therefore, not amenable to hormone therapy. This displacement usually occurs after the organ has passed through the full length of the inguinal canal. It takes place in one of four directions: (1) The superficial inguinal region, where the testis lies lateral to the annulus inguinalis subcutaneous and in the plane between the aponeurosis of the external oblique muscle and the deep layer of the superficial or Colles' fascia. (Figs. 9 and 10.) (2) The pubopenile ectopic (rare) in which the testis rides in front of the pubis at the base of the penis. (3) The femoral ectopic, wherein the testis is found in the region of the femoral or Scarpa's triangle, near the saphenous opening. (Fig. 11.) (4) The perineal ectopic; the testis lies in a superficial perineal pouch under Colles' fascia, producing a swelling anterior to the anus, and lateral to the midline. (Figs. 12 and 13.)

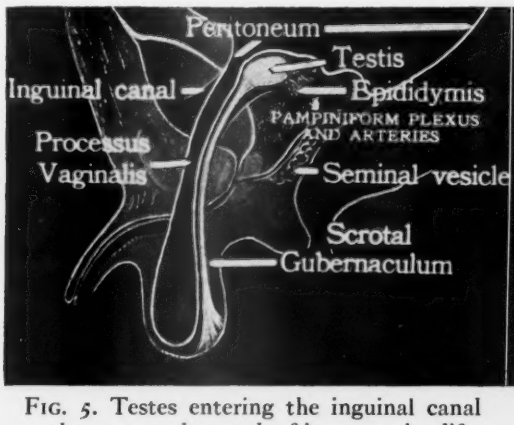

Fig. 5. Testes entering the inguinal canal about seventh month of intra-uterine life.

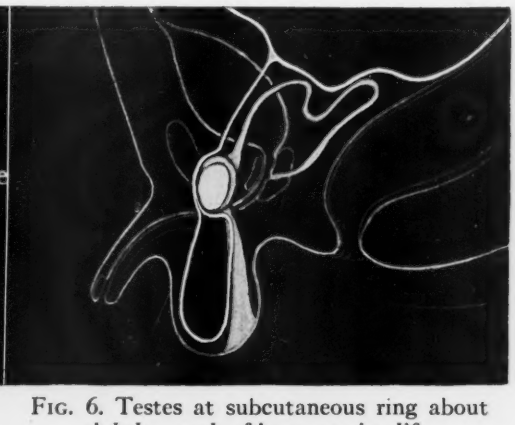

Fig. 6. Testes at subcutaneous ring about eighth month of intra-uterine life.

It should be stressed that the ectopic, unlike the incompletely descended testis, in addition to its normal size is usually accompanied by an indirect inguinal hernia. In children cryptorchidism may be apparent rather than real, for, owing to the spasticity of the cremaster muscle the testis may be displaced in an upward direction and thus be temporarily missing from the scrotum.

Reports vary concerning the histologic appearance of the cryptic testis, probably due to the fact that frequently little distinction is made between the incompletely descended, and the inguinal ectopic organ. Thus, in a report by Pace and Cabot of twenty-four cases of retained testis in the adult, including six in the third, and five in the fourth decade, all the inguinal cases presented some atrophy of the tubules and no increase in the interstitial cells. This prompted the authors to state that it was conceivable that each testis would regenerate an entirely normal germinal epithelium if it were placed in the scrotum. Likewise, DeWiniwater, after a study of two specimens of undescended testes from patients twenty-three and forty years of age, stated that the epithelium of the tubules was sufficiently preserved, so that the possibility of regeneration could not, with reason, be

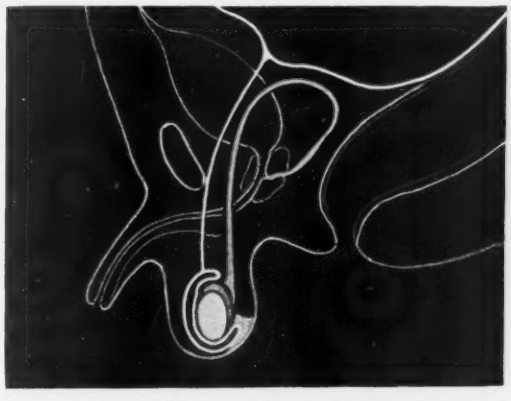

Fig. 7. Testes in scrotum at ninth month of intra-uterine life, normally closed processus vaginalis-ligamentum vaginale.

denied. In four cases of incompletely descended testis in patients between the ages of twenty and twenty-four, in whom testes are similar. After puberty the ectopic testis may fail to generate a mature germinal epithelium because of

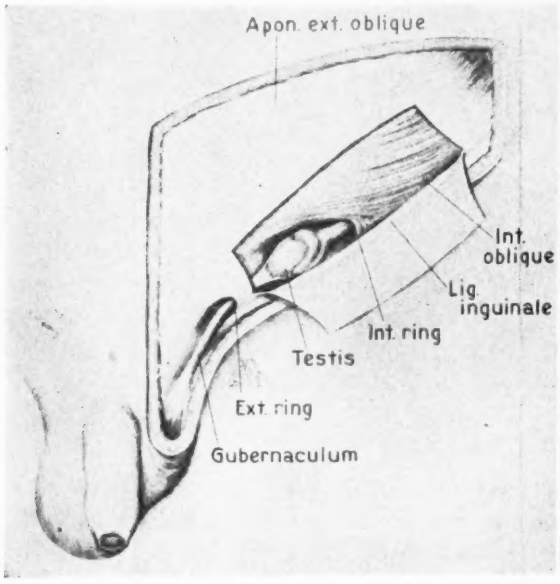

FIG. 8. Small incompletely descended testis; failure of descent probably due to inadequate endocrine stimulus.

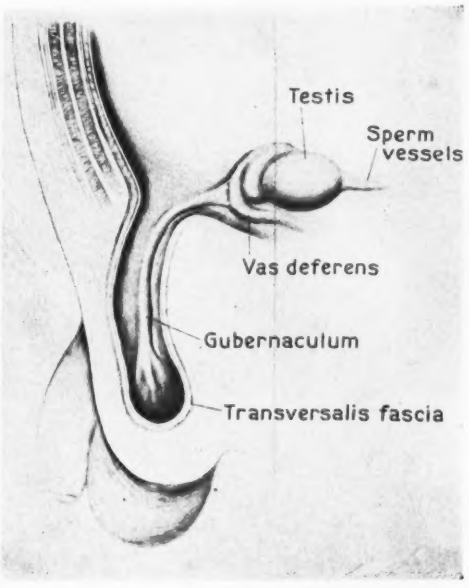

FIG. 9. Incompletely descended testis, normal in size; probably due to anatomic barrier rather than endocrine dysfunction.

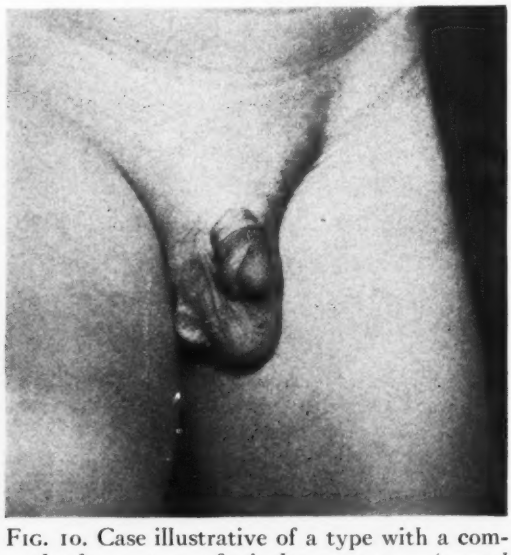

FIG. 10. Case illustrative of a type with a completely patent funicular process (scrotal hernia) in a child ten years old.

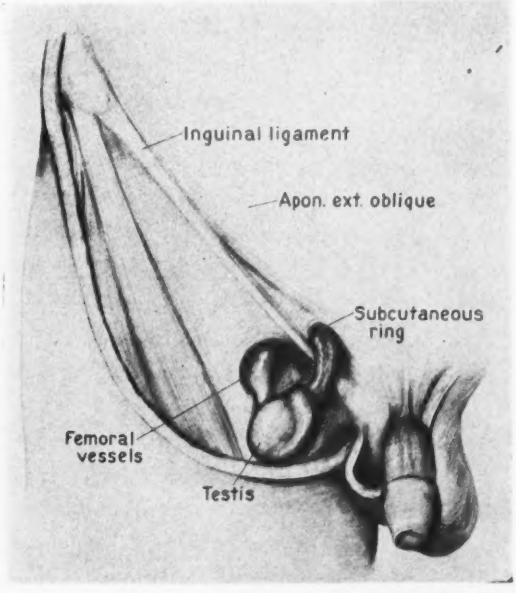

FIG. 11. Abnormal descent of testis showing congenitally displaced testis in the femoral region—ectopic.

the organs were of normal size, I found no atrophy of the tubules, but only slight spermiogenesis.

Treatment. Normally, until about the age of thirteen, little growth occurs in the testis, so that before puberty the histologic appearances of scrotal and undescended the prevalent abnormal temperature outside the scrotum. Here, a mechanical factor, rather than an endocrine substance, determines the condition of the

testis. This distinction between endocrine and mechanical control is a vital factor in the treatment of cryptorchidism. The

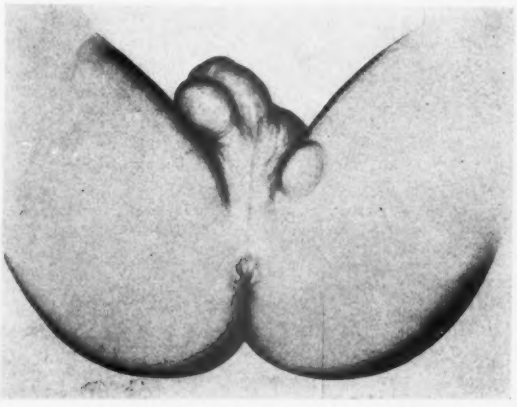

Fig. 12. Perineal ectopic testis.

abnormal anatomic conformations obviously preclude satisfactory effects from hormonal therapy. This is of especial importance where the testis is contained in a congenital hernial sac.

According to Wangensteen, the size of the testis is a fair index of its eventual reaction after having been placed in its natural position in the scrotum. In a small atrophic organ the germinal cells probably disappear and no further development occurs, whereas, in a testis of fair size, in a patient past puberty, it is a reasonable assumption that young germinal epithelium capable of producing mature spermia still survives and that further development will occur.

It has been scientifically established that anterior pituitary hormone stimulates both testicular hormones—the spermatogenic and the androgenic. The undescended testis, as has been repeatedly shown, is defective in spermatogenic substance and must, therefore, be stimulated with anterior pituitary hormone. The urine of the normal child, for example, contains little or no anterior pituitary hormone, but the urine of children afflicted with cryptorchidism contains this hormone.[1] It has consequently been urged that these children with gonadotropic hormone in the urine should receive endocrine therapy before surgical repair is considered.

The following substances are employed in attempts to cure cryptorchidism: (1) The anterior pituitary-like substance which

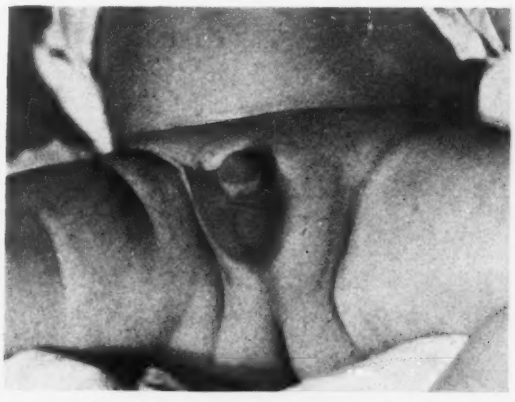

Fig. 13. Child four months old with a left perineal testis. Operated upon at one month for a strangulated right indirect inguinal hernia.

occurs in the urine during pregnancy; (2) extracts of the anterior lobe of the pituitary body proper; (3) pregnant mare's serum. In 1934 Haeussler[2] and Zondek[3] called attention to the fact that a stallion excretes enormous amounts of estrogenic hormone in the urine; that the amount of hormone excreted daily in the urine of the stallion is 400 times as much as that of a mature woman during one month. According to Zondek, the "testicle of the stallion proved to contain the largest amount of estrogenic hormone ever found in any sort of tissue. The mass excretion of follicular hormone is a property exclusively inherent in the male equines—horses, zebra, donkey—and is not encountered in other animals. It is possible, with the hormone produced in the male horse, to feminize other male animals—guinea-pigs—so that the mammary glands eventually secrete milk! This is probably one of the most paradoxical actions of the sex hormones. By using the hormone produced in the male horse, the well known antimasculine effect can be brought about in the testicle of other male animals." According to Zondek the urine of one pregnant mare yields an enormous quantity of hormone, as much as can be obtained from 1,500 women. Zondek quotes Girard[4] to

the effect that the latter investigator isolated from the urine of pregnant mares a few estrogenic compounds which are

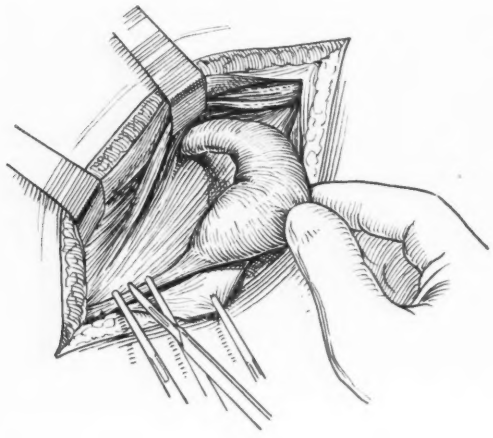

Fig. 14. Elevation of testis to permit dividing gubernaculum between two clamps.

not found in human urine (equilin, hippulin, equilenin). (4) Testosterone propionate: (estrone, estrone-ester, estriol, estradiol, estradiol-ester). The results obtained with the use of these substances, aside from the affectiveness of the hormonal material, depends to a great degree on the anatomic factors: the length of the spermatic vessels of the vas deferens as compared to the length of the inguinal canal through which the testis must pass, the relative size of the testis and the tract, normal or abnormal development of the inguinal canal and scrotum, adhesions of the testis to contiguous or circumjacent tissues and abnormalities of the mesorchium.

Anterior pituitary-like substances are given intramuscularly in doses which vary from 200 to 500 rat units biweekly or once a week. This regimen is continued for a few months—two to seven—and if there is evidence of improvement a rest period may be advised.

Anterior pituitary-like hormone is the choice of available hormones in the treatment of cryptorchidism and poorly developed intrascrotal testes. The dosage should not exceed a total of 10,000 rat units administered for a period of sixteen to twenty-five weeks. Of my series, all

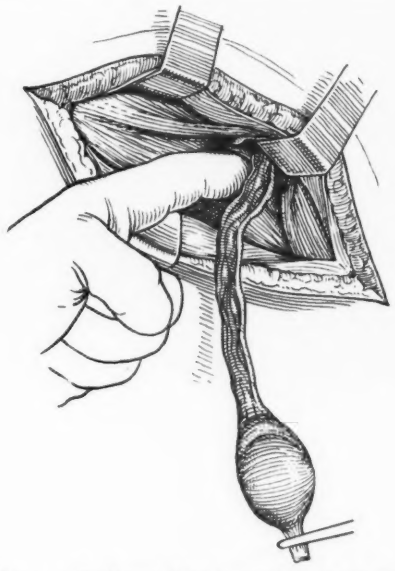

Fig. 15. Indirect hernia sac if present has been removed. Index finger is inserted deep into abdominal inguinal ring to release perivascular synechiae in order to elongate the cord.

patients with incompletely descended testes were treated with gonadotropic hormone. There were satisfactory results in six of these patients. In four others, complete descent was not attained but the size of the gland increased and subsequent surgery proved successful. There is a subsidence of growth when treatment is stopped. Atrophy never occurs as a result of this therapy. Aside from the enlargement of the testicle the endocrine treatment has, admittedly, a few dangers and the patients must, therefore, be strictly individualized. Thompson and Heckel[5] wrote that they "have been struck more by the influence of anterior pituitary hormone substance on the growth of the genitalia than by its influence on the descent of the testis." From this it would appear that the original incomplete descent was due to an endocrine and an anatomic influence, both of which had to be overcome in order to cure the cryptorchidism. Ten other cases were of the ectopic variety of cryptorchidism and excellent results followed early surgical

intervention; the administration of glandular extracts would have been superfluous and perhaps harmful.

tures are visualized through the usual inguinal-scrotal incision. If a hernia is present it is treated in the customary

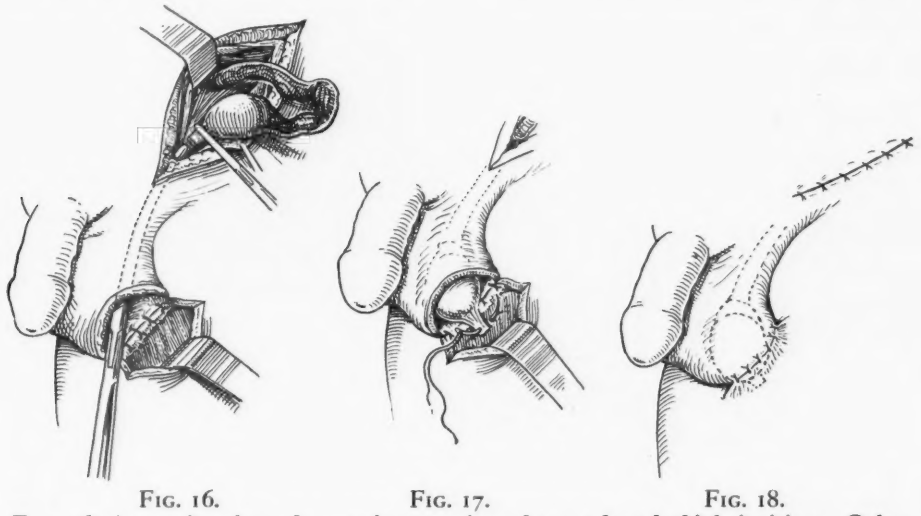

Fig. 16. Fig. 17. Fig. 18.

Fig. 16. Approximation of posterior margins of scrotal and thigh incisions. Gubernaculum is drawn down to lower incisions by a clamp inserted through scrotal opening.
Fig. 17. Suturing gubernaculum to deep fascia of thigh.
Fig. 18. Anterior margins of scrotal and thigh incisions approximated with black silk sutures to cover testis.

Surgical Treatment. The justification for orchidopexy is based on the following grounds: (1) When the testicle is placed in the scrotum, before puberty, it produces hormone and sperm. (2) A bilateral cryptorchid is sterile. (3) Statistical inquiries and studies have shown that malignancy is twice as common in the undescended testis. (4) It is more liable to tortion, strangulation, chronic inflammation and trauma. (5) Epididymial involvement of the scrotal testicle may leave the unilateral cryptorchid sterile, and (6) psychologic influences.

The surgical treatment of cryptorchidism may be begun at any age but preferably before puberty. However, it should not be discarded because the patient is beyond this age. Surgery should not be delayed in prepuberty patients. The sooner the cryptic testis is placed in the scrotum, either hormonally or surgically, the greater the likelihood of serviceable spermiogenic function.

I will refer briefly to the two-stage, modified Thorek operation for ectopic testis: The spermatic cord and its structures are visualized through the usual inguinal-scrotal incision. If a hernia is present it is treated in the customary manner by transfixion, high ligation and exsection of the sac. The testis is then elevated and the gubernaculum is divided between clamps and ligated to permit better mobilization. The vas deferens and its circumjacent structures are then located and a finger is inserted into the retroperitoneal space, as far as possible, in order to liberate adhesions which, if present, may bind the vas deferens and its blood vessels. (Figs. 14 and 15.) Sharp dissection will dispose of small fibrous synechiae. As a rule the vas deferens is sufficiently long to permit the testis to be placed in the scrotum. If the coverings of the spermatic cord and its vessels are too short, care must be exercised to avoid interference with the normal blood circulation when the testis is anchored. The deep insertion of a finger into the scrotum assists in the formation of a bed for the testis. This maneuver is not always a simple matter because the testis, having never descended, formed no hiatus. The insertion of the finger may be obstructed, likewise, by a continuation of Scarpa's fascia.

An incision is then made into the base of the scrotum. A parallel incision, about one and one-half inches long, is made in the contiguous surface of the corresponding thigh. The posterior margins of the scrotal and thigh incisions are approximated and sutured with everting catgut strands. The testis is brought through the lower scrotal wound by traction upon the gubernaculum which is transfixed to the deep fascia of the thigh. (Fig. 16.) It is anchored with plain or chromicised number one catgut on a round, pointed needle; care is taken to avoid the medial saphenous vein. (Fig. 17.) The testis is then covered by suturing the anterior marrins of both the scrotal and thigh wounds with silk or with catgut. (Fig. 18.) The inguinal wound is finally closed without transplanting the spermatic cord to avoid making undue traction upon the testis. Vaseline-gauze is inserted into the cleft above the newly made union of thigh and scrotum and the wounds are dressed in the usual manner.

The patient remains in the hospital about twelve days. Six weeks later he returns to the hospital for one day. The scrotum is now separated from the thigh, the gubernaculum dissected from the deep fascia and the scrotal and thigh wounds separately closed.

SUMMARY AND CONCLUSIONS

In incomplete descent of the testis surgical intervention is contraindicated, except in conjunction with endocrine therapy. In ectopy of the testis surgery is the method of choice and endocrine therapy, obviously, is unnecessary. If it is uncertain in which category a misplaced testis belongs a complete endocrine study should be made and correct hormonal therapy should be instituted. If there is an apparent failure of response, surgical treatment is justified, even if the gland is impalpable. Anorchism is extremely rare.

TABLE 1

Total—100 Cases	
Undescended	Ectopic
48 right	11 right
30 left	7 left
4 bilateral	
Co-existing Patent Funicular Process	
52	13
Results	
5 poor	1 poor
14 fair	2 fair
63 excellent	15 excellent

REFERENCES

1. KATZMAN and DOISY. *J. Biol. Chem.*, 106: 125, 1934.
2. HAEUSSLER. *Chem. Act.*, 17: 531, 1934.
3. ZONDEK. *Nature*, 133: 209, 1934.
4. GIRARD. Quoted by Zondek. *Compt. rend. Acad. d. sc.*, 194: 909, 195: 981, 1932.
5. THOMPSON and HECKEL. *J. A. M. A.*, 21: 220, 1937.

ENDOCRINE FACTORS IN THE MECHANISM OF TOXEMIA OF PREGNANCY

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IN a collective review of the investigative efforts directed toward the elucidation of the fundamental nature of the late toxemia of pregnancy it will be observed that the positive results obtained in the confusing pathways of research are in inverse proportion to the vast amount of energy expended during the past few decades. In the search for the cause of the disease, up to quite recently the placenta was considered the principal factor in some way responsible for the disorder. The underlying reasoning pointed to the hypertensive-albuminuria syndrome as a specific condition peculiar to pregnancy and assumed that it is the presence of the placenta which essentially characterizes the pregnant state. As a corollary, the uniform decrease in blood pressure, albuminuria and generalized edema following evacuation of the uterus was cited as evidence of the primary seat of the disorder residing in the placenta. The occurrence in the overwhelming majority of cases of areas of degeneration and acute red infarcts in the toxemic placenta seemed to bear some etiological relation. Yet, the numerous sincere efforts aimed at the isolation from the placenta of certain consistently present and well defined substances "toxins," which would produce in laboratory animals hypertension and the characteristic lesions in vital organs as well as the alterations of blood chemistry turned out to be disillusioning exercises. The placental sex hormones, which from early pregnancy are found in the blood in concentrations far above anything occurring in the non-pregnant state, have in recent years received considerable attention. High chorionic gonadotropic content of the serum and certain changes in the relative amount of the constituents of the estrogenic fractions have been reported. No acceptable proof, however, has been adduced for the hypothesis which tends to assign to placental hormones the decisive immediate or indirect cause of toxemia of pregnancy.

The selective function of the chorionic epithelium was clearly established as a determining factor in fetal nutrition as long as three decades ago.[1a] There is likewise universal accord concerning the observation that at all periods of pregnancy syncytial fragments are constantly cast off into the maternal circulation from the chorionic villi whose exposed surfaces equal at term 6.5 square meters. Such placental derivatives, carrying various chemical substances which are normally stored in the human placenta, proved experimentally to represent the stimulus for the initiation and maintenance of the hyperplastic changes and the associated increased function of the endocrine chain—adrenal cortex, thyroid, pituitary.[1b] Increased amounts of thyroxin and free iodine in the blood (G. Curtis, Anselmino, Eufinger) and, histologically, the pattern of glandular thyroid hyperplasia have been established as regular attributes of normal gestation, as well as the hyperplasia of the adrenal cortex quite similar to the phenomena observed in Cushing's syndrome.[1f] Quite recently similar structural changes of the adrenal cortex have been found in the fetus, and extracortical secretion is being claimed in fetuses of toxemic mothers.[2] In recent years, in addition to the well known structural changes in the adenohypophysis increased secretion of the basophiles in the anterior lobe of the pituitary gland during the last trimester of gestation has been demonstrated.[3] Basically, it is the profound

constitutional alteration resulting from these biological events which gives the pregnant state its peculiar stamp. With the placental stimuli in abeyance following the termination of pregnancy, the heightened activity of the endocrine chain referred to returns to normal and the hormonal imbalance, subsequently to be detailed as the dominant note in the mechanism of the late toxemia, readjusts itself. Furthermore, elimination of painful uterine contractions following the detachment of the placenta removes an active stimulus of postpituitary secretion as evidenced by the experimental observations of A. A. Danilov, Chang and Lim. These considerations, in conjunction with the recent denial of the etiological significance of placental red infarcts in toxemia by a number of competent observers (Falkiner, Fitzgibbon) indicate that we are obviously in the midst of a reorientation and a revision of the traditional and for decades almost axiomatically held doctrine which considered the placenta the cardinal factor in the etiology of the hypertensive toxemia of pregnancy.

Pursuing the train of investigation and thought originated in 1918 to the effect that in the causation of the syndrome termed late toxemia of pregnancy, consideration of hyperdynamic posterior pituitary principles may bring us within measurable distance of the realities of the situation, the pertinent data presented up to 1933 were collected and collated.[1b] The recorded experimental, morphological, and chemical facts relevant to the subject combined to afford ample proof for the view that it may be reasonably concluded that toxemia represents disordered autonomic physiology as the result of an undue posterior pituitary (pitressin) effect. Along this trend, efforts to identify in the blood an excess of the pressor-antidiuretic pituitary principle stirred much comment with denials of positive findings in late toxemia in preponderance. However, an overwhelming array of impressive facts buttressed the new tenet. The striking similarity between the cardinal features of blood chemistry in eclampsia and in experimental hyperpituitarism, notably anoxia of the tissues, the consistently present melanophore expanding principle in the blood in toxemia, as well as the corroborated clinical evidence of an increased susceptibility of toxemic individuals to pitressin, had first call. As quoted in a subsequent paper, in extensive studies Knepper was able faithfully to reproduce the well known lesions in vital organs in eclampsia by first parenterally administering proteins and subsequently pituitrin to laboratory animals, thus simulating the effect of the detachment into the maternal circulation of chorionic tissue, fetal proteins, which apparently sensitize the organs to the effect of pitressin.[1f] In addition, impaired excretory liver function during the second half of normal pregnancy occurring in 40 per cent of the cases studied, was considered a factor which may interfere with the normal process of detoxification of pitressin.[1e] Finally, atony and dilatation of the ureter known to be constant concomitants of gestation and usually amenable to the influence of the posterior pituitary principle are uncommon in preeclamptic toxemia, suggesting the effect of the pituitary factor.[1d] The well coordinated investigations of C. Mukherjee recently elaborated on the above aspects of the problem in a wider latitude and offered cogent evidence of increased concentration in the blood of the vasopressor, antidiuretic, and melanophore principle in late toxemia.[4] By small repeated doses of pitressin injected intraperitoneally Griffith produced in rats permanent hypertension[5] while Leimdoerfer observed the same effect with intrathecal injection of posterior pituitary extract.[6] The recent experimental studies of Netzel shed further light on the transcendent importance of pitressin in the origin of lesions in the liver and kidney in eclampsia, by way of vascular spasm and anoxia.[7]

Current interest attaches to the recent discovery of a dynamic equilibrium main-

tained during normal gestation between the opposing effects on the blood pressure of placental acetylcholine and a set of endocrine factors which conduce to intrinsic hypertonicity and augmented reactivity to vasopressin of the arterioles, i.e., overactivity of the thyroid, adrenal cortex, pituitary basophiles, associated with flooding of the blood with estrogenic and gonadotropic substances. Dislocation of this equilibrium in toxemia is reflected in the low acetylcholine content of the placenta as determined in twenty-eight cases, and the resulting inadequately opposed action of naturally secreted vasopressin.[1f] Damage to the storing capacity of the placenta has of late been demonstrated by Nixon and Wright, and Nisino[8,9] in regard to vitamin B and C and may justly be correlated with the universally recognized occurrence of degenerative placental lesions (J. Young) in late toxemia. A significant increase of cholinesterase in the toxemic placenta with rapid destruction of acetylcholine was stressed in a previous paper[1f] and received full confirmation at the recent meeting of the Am. Med. Association by R. Woodbury.*

*A paper entitled "Influence of Neostigmine on Eclamptic Patients and Cholinesterase Activity of Normal and Preeclamptic Human Placentas" was presented by Dr. R. A. Woodbury and Lieut. P. H. Fried at the 1944 Convention of the A. M. A. This paper fully confirms my results published previously. By invitation I discussed Dr. Woodbury's paper and it was generally believed that the investigation concerning the true cause of toxemia has been put on the right track.

The admirable investigations of C. Heymans (Ghent), revealing the automatic regulation of the blood pressure by the action of pressoreceptors and their ready response to pressor changes and to acetylcholine, turn the limelight on data consistent with the above physiological approach which for simplification and clarity of the problem aims to convey a unifying concept of the pattern of the hypertensive toxemia of pregnancy. In this connection the recent information concerning the lowered rate of acetylcholine production in petit mal (Waelsch and Nachmansohn) is worthy of note, as well as the experimentally established fact that pitressin enhances induced convulsions while acetylcholine causes inhibition.[10]

REFERENCES

1. Hofbauer, J. *a.* Biology of the Human Placenta. Vienna, 1905. *b, Am. J. Obst. & Gynec.*, 26: 311, 1933. *c, Zentralbl. f. Gynäk.*, p. 2482, 1937. *d, Bull. Johns Hopkins Hosp.*, 42: 118, 1928; *J. Urol.*, 20: 413, 1928. *e, Am. J. Obst. & Gynec.*, 41: 718, 1941; *f. West, J. Surg. & Obst.*, 40: 615, 1941.
2. Parks, T. J. *J. Clin. Endocrinol.*, 1: 784, 1941.
3. Severinghaus, A. E. *Physiol. Rev.*, 17: 566, 1937.
4. Murkherjee, Ch. *J. Obst. & Gynaec.*, Brit. Empire, 48: 586, 1941.
5. Griffith, J. C. *Am. Heart J.*, 27: 77, 1941.
6. Leimdoerfer, A. *Arch. Exper. Pathol. & Pharmacol.*, 118: 25, 1926.
7. Netzel, A. Vascular Spasm. Chicago, 1942. University of Illinois Press.
8. Nixon, W. C. and Wright, D. *Brit. M. J.*, 1: 604, 1942.
9. Nisino, O. *Clin. Abstr.*, 35: 287, 1941.
10. Keith, H. M. *Arch. Neurol. & Psychiat.*, 33: 393, 1935.

CRITICAL ANALYSIS OF MAMMECTOMY AND FREE TRANSPLANTATION OF THE NIPPLE IN MAMMAPLASTY

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MAMMECTOMY with free transplantation of the nipple was initiated to simplify the available methods of breast reconstruction. Some practitioners of this procedure do a complete bilateral mammectomy prior to the "grafting of the nipple." Others do a subtotal resection of the breast, including the central part of the gland and nipple. This paper will examine the indications for this method of mammaplasty in the light of present day knowledge.

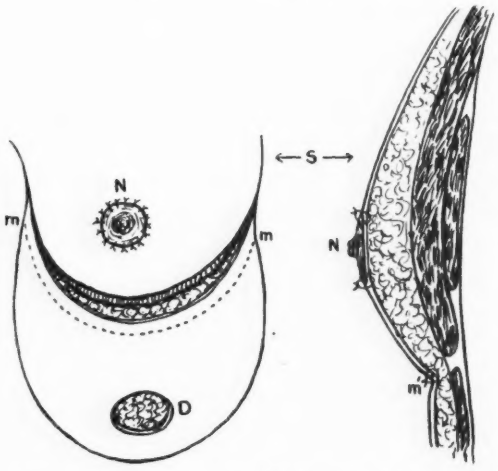


FIG. 1. Mammectomy with free grafting of the areola and nipple; D, defect following detachment of areola and nipple by sharp dissection; N, free areola—nipple graft sutured to a circumscribed denuded surface following removal of a superficial layer of derm; S, upper horizontal flap to be sutured in the submammary sulcus (*mm*) after excision of excess fatty and glandular tissue.

The procedure as outlined in the illustrations is as follows. (Fig. 1.) The areolae, including the nipples, are circumcised on each side and detached from the subjacent structures by sharp dissection. The free areolar graft, including the covering of the nipple, is then sutured to a circumscribed area on the anterior flap. Horizontal incisions are made on the anterior aspect of the breast, directly above the areola and in the submammary fold, through which the skin and all or most of the glandular tissue, including the nipple, are excised. The free edge of the skin flap is then sutured in the submammary fold. In either case the central part of the gland is sacrificed.

INDICATIONS FOR PARTIAL OR TOTAL AMPUTATION IN BREAST HYPERTROPHIES

The originators of the procedure[1,2] based its indications on the assumption that most of the methods described for the repair of large breast hypertrophies are difficult to execute. With regard to this question, the following data are pertinent:

The term, hypertrophy, covers both true hyperplasia of the mammary glands, which is rather rare, and other forms of breast overdevelopment, such as fatty hypertrophy, hypertrophy as the result of mastitis, and congenital asymmetrical hypertrophy in which one breast is larger than the other. It is important to distinguish between true hyperplasia and the ordinary oversized fatty breast, as the treatment and prognosis of these conditions differ radically.

True hyperplasia is characterized by marked increase in the glandular structures, with only a slight augmentation of fatty tissue. The hypertrophied breast of puberty is the most frequent type in this group. It attains enormous proportions, often extending below the umbilicus. This is frequently accompanied by disturbances of the general health. In this type of hyperplasia, in which the exuberance of glandular structures may border on malignancy, the safest procedure is subcutaneous

amputation, after which the missing nipple may be camouflaged by free grafting of the areola or by tattooing a reconstructed preserve as much mammary function as possible. (4) There should be no conspicuous scarring.

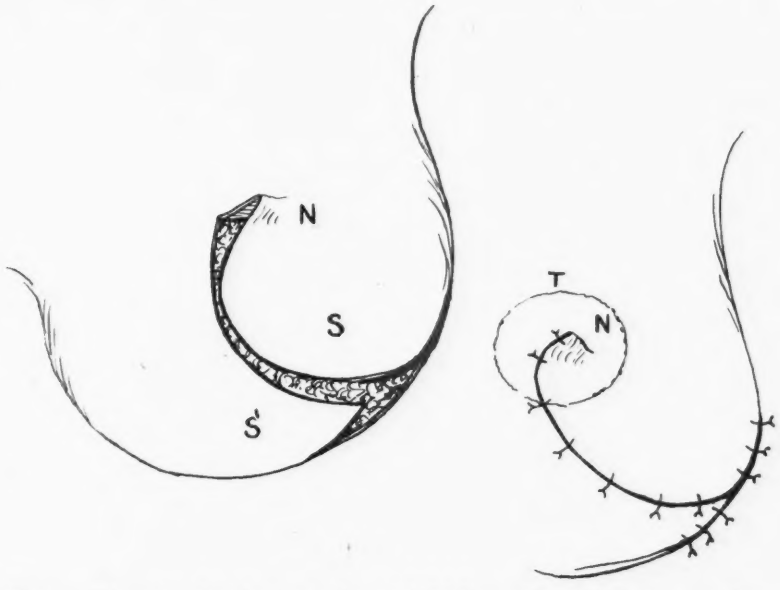


Fig. 2. Diagram showing rotation and folding of lateral flap, S, to simulate protrusion of nipple; S, skin flap rotated along the lateral lower quadrant; N, folding of flap at the level of nipple; T, tattooed area.

protuberance of the skin simulating the nipple. (Figs. 1 and 2.)

However, by far the most common types of breast hypertrophies are due to excessive fatty degeneration of the gland, with glandular tissue scarce.

Another type is caused by mastitis. Here the breast consists of multiple fibrotic nodules or cysts of varying size and number. Among the congenital types of relative hypertrophies, the only abnormality common enough to warrant comment is mammary asymmetry.

Any procedure for plastic repair of a hypertrophied breast should rest on a sound anatomical, physiological and artistic foundation. The problem is not limited to reduction in size but involves such factors as permanence of result, postoperative function and distant prognosis.[3] The following are essential requirements: (1) The blood supply of the breast must be preserved. (2) The gland must be properly shaped and firmly affixed in a normal location. (3) Extensive injury to the galactophor ducts should be avoided to

Mammectomy as a procedure of repair for benign hypertrophic breasts lacks all these essential requirements. Except in true hyperplasia, it should be condemned as a mammaplastic method because it is unnecessarily drastic and crippling, in contrast with a two-stage procedure, in which the central part of the gland including the nipple can always be safely preserved.[4]

INDICATIONS FOR FREE TRANSPLANTATION OF "NIPPLE" AND AREOLA

Following mammectomy, to camouflage the amputated central part of the gland, a free graft of the areola and "nipple" is supposedly transplanted on the anterior surface of the skin flap. From the illustrations furnished by the originators of this method (Fig. 1) it is evident that the areolar skin is superficially dissected together with the covering of the nipple. Under no circumstances can the nipple itself, in the anatomical sense of the word, be successfully transplanted free.

A few anatomical data on the structure of the nipple and areola are pertinent at this point. The normal nipple forms a hemispherical eminence in the center of the areola. It is a truncated cone, the surface of which is flattened, marked usually by pits or a multitude of minute, wart-like protuberances. It is covered by a modified integument that gives it a wrinkled or even a warty appearance.

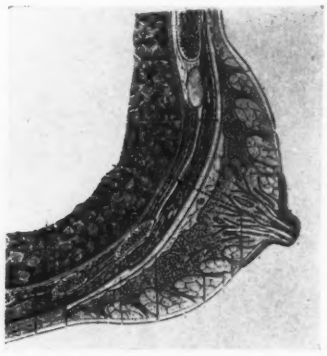
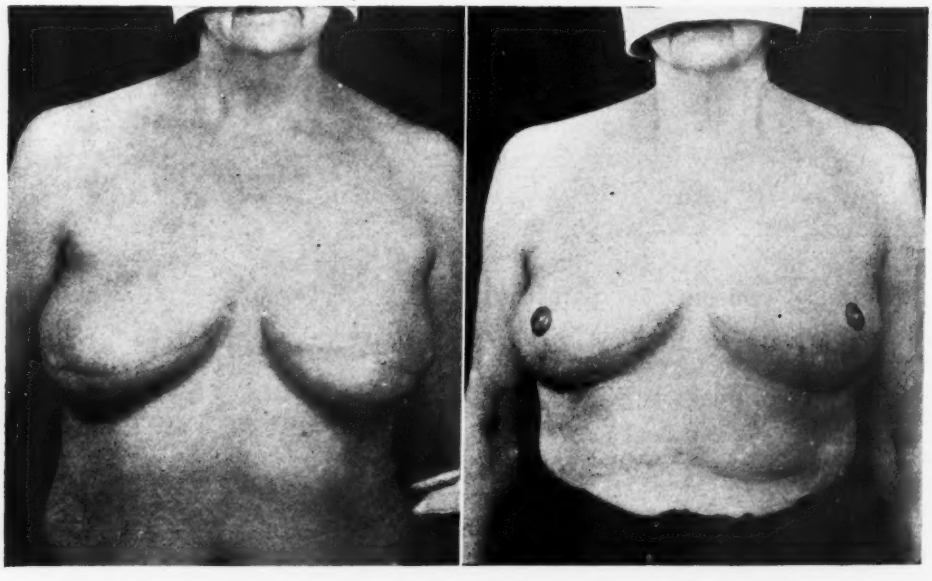


Fig. 3. Structure of nipple; dense areolar tissue with muscular fibers arranged in bundles through which pass the ducts. The nipple *in toto* thus cannot be transplanted free.

Microscopically, the nipple is seen to consist of dense areolar tissue with numerous muscular fibers arranged in bundles, half perpendicular to the surface and half disposed circularly about the deeper structures. Erection and elongation of the nipple depend entirely upon contraction of the muscular element. The other characteristic structures are the ducts which pass through it vertically from the glandular tissue below. (Fig. 3.)

The areola is a well marked zone of pigmented skin surrounding the nipple. Its warty appearance arises from the Montgomery glands whose ducts open on its surface.

The anatomical construction of the nipple suggests that it can be preserved in mammaplasty only when it remains attached to the central part of the gland as in the buttonhole procedure, in which



A B

Fig. 4. A, deformity following mammectomy in a woman aged forty-eight done elsewhere twelve years previously for benign breast hypertrophy. The disfigurement was a source of great distress especially because of the loss of nipples, about which the patient was not advised prior to surgery. B, early condition following a secondary mammaplasty. Attempt was made to improve the shape of the breast by affixing the remaining mammary structures to the pectoral fascia in a higher position and removal of excess skin along a vertical incision above and below the old operative scar. The camouflaging of the nipple was done by producing a cone-like protuberance through folding the upper end of a lateral flap (Fig. 2) and tattooing the central segment of the breast.

the circumcised areolar skin is transplanted with the gland to a higher location.[5]

It is alleged by some that the freely transplanted nipple survives "if the proper technic is used." To those familiar with grafting of tissue, it is evident that it is impossible to transplant the nipple free by now available technics. Microphotographic illustrations of such grafts point to the presence of skin elements only. Proof of the possibility of free transplantation of the nipple would require microscopic evidence of muscular fibers and ducts obtained from sections of the transplanted tissue. Till now, such evidence remains lacking.

The free grafting of the areolar skin can be carried out to the same extent as the grafting of any other type of skin. However, the appearance of this grafted areola is far from simulating the normal contour of the nipple. In rare cases in which subcutaneous amputation of the mammary gland is indicated, as in true hyperplasias, the areolae can be used as free grafts on the anterior flaps; but the patient should be advised of the true facts of the procedure.

Patients in whom free areolar transplantation was omitted or has proved unsuccessful frequently apply for secondary repair. In such cases, the missing nipple can be camouflaged by tattooing the skin. In other instances a protruding cone, simulating the nipple, has been achieved by rotating the lateral skin flap through a midline incision; the protuberance is subsequently tattooed. (Fig. 4.)

SUMMARY AND CONCLUSIONS

1. Mammectomy, as a plastic method for benign hypertrophy, is a crippling procedure injurious to the physical and mental health of the patient.

2. The "take" of a freely transplanted nipple is technically impossible, as the ducts and muscle fibers will unavoidably slough. Freely grafted areolar skin usually "takes" in the same manner as any other type of skin.

3. To preserve, during mammaplasty, the vitality of the nipple, it should remain attached to the central portion of the gland. The procedure can usually be done safely in two stages.

REFERENCES

1. Thorek, Max. Histological verification of the efficacy of free transplantation of the nipple. *Med. J. & Rec.*, November, 18, 1931.
2. Dartigues, L. *Arch. franco-belges de chir.* April 4, 1925.
3. Maliniac, J. W. Breast deformities—anatomical and physiological considerations in plastic repair. *Am. J. Surg.*, 39: 54, 1938.
4. Maliniac, J. W. Prevention of necrosis in plastic repair of the breast. *Am. J. Surg.*, 26: 292, 1934.
5. Maliniac, J. W. Arterial blood supply of the breast. *Arch. Surg.*, 47: 329, 1943.

ULTRAVIOLET BLOOD IRRADIATION THERAPY (KNOTT TECHNIC) IN NON-HEALING WOUNDS*

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IT is generally recognized today that there occurs in a very low percentage of individuals who have recovered from the immediate effects of wounds a failure in healing, despite the very best local treatment plus normal supportive measures such as infusions, transfusions, rest and adequate diet. This failure is apparently due to the absence in such individuals of a specific resistance factor, intrinsic in nature and of unknown character, often referred to as a general resistance factor. In any case, wounds do not heal normally in these few individuals as contrasted to the relatively rapid healing of wounds in most individuals.

Acting on the belief that a normal ultraviolet balance might be absent in such individuals and that a resultant ultraviolet deprivation might be closely connected with the absence of the necessary specific resistance factor which regulates normal wound healing, we have in the past five years applied to six individuals with non-healing wounds the Knott technic of ultraviolet blood irradiation therapy. The duration of the non-healing wound in each of these individuals up to the time of the use of this method varied from five months to six years.

In one of the individuals a non-healing fecal fistula was present; in two, multiple extensive non-healing lesions of the skin and soft tissues; in one a post-incisional failure of abdominal fascia and muscle to close despite several resuture attempts; in one a 3 inch by 3½ inch leg ulcer, and in one a non-healing amputation stump.

The rapid appearance of wound healing in and the recovery of all six of these individuals in a most convincing fashion has led us to believe that possibly ultraviolet deprivation played some part in the persistent failure of the normal healing process to appear in each instance.

CASE HISTORY ABSTRACTS

CASE 1. Mrs. A. H. was first seen July 15, 1940, at which time her chief complaint was a discharging fistula from the terminal ileum, right lower side, approximately 7 cm long. She gave a history of an appendectomy in 1920, the presence of abdominal adhesions in 1922, acute abdominal pains in 1933 followed by the removal of a chocolate cyst of the ovary November 9, 1933. Two weeks after this operation an abdominal abscess was drained, and five weeks after the removal of the ovarian cyst an exploratory laparotomy was performed with negative findings. Shortly afterward a bleb appeared at the site of the laparotomy incision followed by a fecal discharge, and another laparotomy was performed at which time an enormous abscess was found and evacuated. Three months later she was discharged from the hospital with the fistula still open. In 1935, she was operated upon for three fistulas with a failure to close in all three. In 1936, while in Norway, fistulas were operated again with an evacuation of abscesses which had formed in the meanwhile. Since this, her last operation, she has had one fistula which closed for six months in 1939 but reopened and was draining freely when first examined here.

Physical examination revealed a highly apprehensive woman of thirty-three with an obvious fecal fistula in the right lower quadrant. A marked mental depressive state was noted as well as generalized weakness. Her temperature was 98.4°F., pulse rate 76, respiratory rate 18, blood pressure 96/60. Routine labora-

* From the Blood Irradiation Clinic, Hahnemann Medical College and Hospital, Philadelphia.

tory examinations were as follows: hemoglobin 14.6 Gm., red cells 3,650,000, white cells 11,100, urea N. 14, cholesterol 200, total proteins 6.62, total calcium 11.9, creatinine 1.6; Wassermann and Kahn tests negative.

At this time the patient was told that her general condition might be benefited by ultraviolet blood irradiation therapy, that it was doubtful whether any healing of the fistula could be expected from this alone, and she was advised to have surgical repair of the fistula following four blood irradiations. The patient refused to consider operation at all, but insisted on having ultraviolet blood irradiation therapy which she was given for the first time on July 15, 1940. A few minutes later she developed a citrate chill which subsided rapidly.

Ultraviolet blood irradiation therapy was repeated on August 16, 1940 and by October 11, 1940, her general condition was greatly improved and a third blood irradiation was given.

On December 2, 1940, ultraviolet blood irradiation therapy was repeated. At this time the fecal fistula was found to be free of discharge and apparently healed. The fistula remained healed throughout 1941, 1942 and 1943, during which time ultraviolet blood irradiation therapy was repeated twice annually. Ultraviolet blood irradiation therapy was given last on January 22, 1944, at which time the patient was apparently in excellent health, and had suffered no recurrence of the fecal fistula which has now remained healed for more than three years.

CASE II. Mr. V. A., age twenty-one, was first seen November 11, 1941. His chief complaint was a non-healing ulcer of the right leg which had occurred following a "floor burn" incurred while playing basketball in November, 1940. Physical examination revealed the patient to be in apparently excellent general condition, except for the non-healing ulcer which had slowly but steadily enlarged to the size of approximately 3 inches by 3½ inches. Application of various ointment and salve preparations had failed to promote healing over a period of twelve months.

After ten days' application of boric acid ointment which produced no change whatsoever the patient was given ultraviolet blood irradiation therapy. At this time laboratory examination, including serological investigation, proved to be entirely negative. At the end of five days tiny but definite granulation tissue was observed to be present at the base of the ulcer. In ten days the ulcer was approximately one-half its original size and fresh granulation tissue was abundant. In two weeks the ulcer had almost completely closed and complete healing of the ulcer was apparent by the twenty-fifth post-irradiation day. The ulcer had remained healed up to the time the patient was last heard from which was in November, 1942, approximately one year later.

CASE III. Mrs. F. M., age thirty-nine, No. 63527, was admitted on July 19, 1940, with a provisional diagnosis of osteomyelitis. Her past history included a history of amenorrhea since January, 1940, and a doubtful liver abscess in April, 1937. Physical examination revealed a cachectic white female with a marked pallor and suffering from two discharging sinuses of the left thigh and one similar lesion of the right elbow. Her temperature was 99.0°F., pulse rate 120, respiratory rate 20.

X-ray examination of the chest was negative; *x*-ray examination of the right elbow showed evidence of a loss of 50 per cent of the olecranon process of the ulna, no evidence of activity at this time; *x*-ray of the femur showed no evidence of bone changes; *x*-ray of the left tibia showed condensing osteitis but no evidence of an active destructive process; further *x*-ray examination showed no evidence of dental disorder nor of destructive bone disturbances of the bones of the face.

Laboratory examination revealed the following: A negative urinalysis; negative Wassermann and Kahn tests; a negative Friedman test; 9.6 Gm. hemoglobin, 3,880,000 erythrocytes, 13,000 leukocytes with 71 per cent polymorphonuclears, 29 per cent lymphocytes; her sedimentation rate was 15 mm. at 15 minutes and 32 mm. at 45 minutes. Blood culture on July 22, 1940, showed Staphylococcus aureus, a possible contaminant. All attempts to find tubercle bacillus in the discharging sinuses were negative. A pathogenic strain of Staphylococcus aureus consistently was found in the purulent exudate of the discharging sinuses.

As a result of these findings many diagnoses were made including staphylococcus and tuberculous osteomyelitis, extensive subcutaneous cellulitis similar to that observed in lesions

produced by a micro-aerophilic streptococcus, and a chronic Staphylococcus aureus cellulitis; the latter alone had bacteriological evidence in its favor.

On July 22, 1940, ultraviolet blood irradiation therapy was given by Dr. Alfred Tuttle. No improvement was noted at this time. The patient's general condition continued to deteriorate slowly.

A Mantoux test done July 30, 1940, was strongly positive. A gastric analysis done the following day showed no abnormal findings. Blood culture taken August 2, 1940, was negative.

At this time it was believed that the patient was also suffering from gallbladder colic and generalized arthritis. Despite the application of sulfanilamide and zinc peroxide ointment plus the application of generalized ultraviolet to the skin, the patient's discharging wounds became enlarged and her condition progressively worse. It was decided on December 20, 1940, to resume ultraviolet blood irradiation therapy as a general supportive measure, since the patient's general condition seemed hopelessly debilitated and her recovery had been judged to be highly doubtful. Blood irradiation was given at this time by Dr. Solon Boynton.

On March 11, 1941, blood irradiation therapy was repeated at the request of the patient who stated that following this treatment she felt generally improved, but the patient responded only very slowly in our opinion insofar as the draining lesions were concerned. Her general condition seemed somewhat improved and it seemed at this time as though she was for the first time out of immediate danger. The patient had required frequent pantopon and morphine administrations for severe pain throughout this period. She did not seem to respond to any therapy whatsoever at this time, although she had managed to survive somewhat longer than had been expected.

On May 31, 1941, ultraviolet blood irradiation therapy was given and the patient was discharged from the hospital with several discharging sinuses. At this time she stated that following blood irradiation she always felt stronger for several weeks, so she was advised to come back as an out-patient for this therapy. The final diagnosis on leaving the hospital was chronic staphylococcus cellulitis, chronic osteomyelitis, chronic arthritis, chronic cholecystitis, contraction flexures of both arms and both legs. At no time had any definite evidence of tuberculosis been found.

On August 19, 1941, the patient was brought into the blood irradiation clinic and ultraviolet blood irradiation therapy was repeated. She apparently was somewhat stronger, the lesions on both arms had healed although the lesions on the body and legs still were draining.

The patient was then given successive blood irradiations on October 10th and November 13, 1941 and January 9, 1942, on which latter date she gave a history of having had an abscess of the cervix incised and drained one week previous to treatment. Ultraviolet blood irradiation therapy was continued March 10th and May 6, 1942, at which time her skin lesions had almost entirely healed and her general condition was good for the first time. This therapy was repeated July 1, 1942, at which time the patient was ambulatory for the first time, although two skin lesions had reappeared. On September 9, 1942, one skin lesion of the leg remained, she was able to walk fairly well, and her general condition was still good.

From this time on blood irradiation was given the patient November 18, 1942, January 15th, March 30th, August 12th, October 19th and December 28, 1943, and March 7, 1944. During this period of time contraction deformities of both knees had disappeared as had that of the right elbow with the help of good physical therapy applied locally. All skin lesions have remained healed. The patient was able to resume a limited normal life with the exception of flexure contracture of the left elbow. Her sedimentation rate and laboratory findings have been within normal limits for more than one year previous to the time last seen which was March 7, 1944. All clinical signs of chronic cellulitis, chronic arthritis, chronic osteomyelitis and chronic cholecystitis have been absent for more than one year.

The rehabilitation of this apparently hopelessly incapacitated woman has been most satisfactory.

Case IV. Miss C. S., age twenty-eight, No. 56447, was first admitted to the hospital October 5, 1940, with the classical signs of high intestinal obstruction, and operation was performed for adhesions of the third portion of the duodenum as well as a band of adhesions from the lower ileum to the lower angle of a previous abdominal incision. The patient

recovered quite well but a small area of necrotic skin remained between the old right paramedian incision and the new left paramedian incision. The patient was discharged on October 31, 1940.

On August 12, 1941, she was readmitted, and an elliptical incision was made around a draining sinus which reached down to the rectus fascia. Pathological examination of the specimen revealed a fistula lined by non-specific granulation tissue. The patient was discharged three days later with the wound still draining.

On October 8, 1941, this patient was again readmitted and the draining sinus was opened and packed by iodoform gauze, but this time the patient had become quite apprehensive, extremely depressed and had suffered from insomnia for the previous six months. Anorexia and a loss of weight were both present at this time. On October 15th she was referred to the blood irradiation clinic in the hopes that a general supportive measure might be of value. On that day ultraviolet blood irradiation therapy was given. The same evening the patient slept soundly for the first time in several months, and continued to do so until her discharge from the hospital October 18, 1941. Her general condition seemed to improve although the sinus to the rectus fascia which had been packed by iodoform gauze continued to drain.

A second blood irradiation was given November 22, 1941, and the patient's health improved enormously with a complete disappearance of anorexia, insomnia and weight loss which loss was regained completely in the two months following the first blood irradiation. The sinus failed to heal and we recommended that the patient have another surgical removal of the offending sinus on the grounds that since her general condition had improved so greatly it was entirely possible that wound healing would occur following complete removal of this sinus. The patient reluctantly consented to this further surgery, and on March 19, 1942, the sinus tract was extirpated. The postoperative wound healed completely and has remained healed for two years. The patient's general health has remained good.

Case v. Rev. M. W., age thirty-eight, No. 50625, was admitted to the hospital November 29, 1939, following an automobile accident. Physical examination revealed fracture of the right femur and severe lacerations of the right forearm involving the whole extensive surface of the forearm, with an associated severance of the extensor pollicis longus tendon. The tendon was repaired immediately on admission and healed quite well. The patient's general condition improved and he recovered from the acute effects of his accident fairly well.

In this patient, however, despite all known general and local therapy, there occurred a non-union of the right femur and a failure to heal of the extensively lacerated area on the right forearm. This condition persisted for approximately five months, at the end of which time ultraviolet blood irradiation therapy was recommended. On April 24, 1940, ultraviolet blood irradiation therapy was given this patient and within a week following this healthy granulation tissue appeared for the first time at the base of the lacerated wound in the right forearm. The wound began to close rapidly one week after irradiation and was healed completely in eighteen days. On March 7, 1940, *x*-ray examination of the right leg revealed, in comparison to the previous *x*-ray taken April 11th, a definite increase in the amount of calcification about the fracture line near the mid-point of the femur. The patient was discharged on May 21, 1940, with the clinical signs of union of the fracture of the right femur almost complete and with the patient himself in apparently good condition.

Case vi. Mr. T. G., age fifty-six, No. 69618, was admitted to Hahnemann Hospital complaining of pain in both feet. Examination of his feet revealed a dry gangrene of the right great toe and a swollen tender area on the medial side of his left heel. Both ankles were swollen. On May 14, 1941, neither tibial nor dorsalis pedis pulses were palpable. The patient gave a history of having had his feet frozen several times in the last ten years. During the past summer the patient apparently had symptoms of intermittent claudication. In November, the patient noticed that the right great toe was sore and this continued until April, 1941, when he injured this toe and it became infected. The toe was incised to establish drainage but the toe only became worse and turned black. He came to the accident ward seeking help and was admitted on May 14, 1941. The urinalysis, blood count,

blood sugar and blood urea were all normal. Wassermann and Kahn tests were normal. Blood culture was sterile after 120 hours' incubation. Temperature was relatively normal except for a small rise in temperature to 99.0°F. each evening. Treatment was instituted as follows:

The legs were covered with a heat cradle and elevated on pillows. Dilaudid gr. 1/16 was necessary to control the pain; 150 cc. of 5 per cent saline were given daily for three days and then three times weekly. On May 16, 1941, the vacuum pressure boot was started on both legs. The saline and the boot seemed to aggravate the condition so that they were stopped on May 22, 1941, and the patient was advised amputation of the right leg above the knee because of the mortification setting in half way to the right knee. On May 25, under cyclopropane-oxygen anesthesia the right extremity was amputated just above the knee using the guillotine method. Good hemostasis was obtained, the flaps approximated and the incision closed with drainage.

Following this operation the patient was very much improved and had very little discomfort. The sutures and drains were removed May 31st and the patient was ordered out of bed. Dressings were changed daily.

On June 12th, the patient began to complain of the left heel which had apparently been healed. Whirl-pool bath was ordered daily. The patient then began having pain in the stump and the left heel and on June 15th a nerve block was ordered. Since the whirlpool bath apparently aggravated this pain, it was discontinued.

On June 17th, a lumbar sympathetic nerve block was done; just before the block an abnormally high skin temperature was recorded. The patient was not relieved of pain and the temperature of the leg did not change. This was repeated on the 19th without relief to the patient. The patient complained almost constantly of pain in the left heel which had now become swollen and edematous. Pain continued until blood irradiation was performed on June 27th. Following this irradiation the swelling went down in the left foot and the area on the left heel began to heal and granulate. The stump of the right leg was almost completely healed following this and the drainage was negligible.

On July 3rd, the patient was discharged free of pain both in the right amputation stump and in the left heel, along with slight drainage from the left heel and the stump of the right leg.

THEORETICAL CONSIDERATIONS

In view of the fact that there seems to have been a definite connection between the use of ultraviolet blood irradiation therapy in the reappearance of the normal healing mechanism in these six consecutive cases of non-healing wounds, one must consider the possibility of supplying by ultraviolet blood irradiation therapy a missing non-specific factor to individuals suffering from similar non-healing wounds, such as may be encountered in war injuries.

It is our considered opinion that ultraviolet blood irradiation therapy may be of definite value in the treatment of non-healing wounds.

CONCLUSION

Further and extensive application of ultraviolet blood irradiation therapy in the treatment of non-healing wounds seems indicated.

USE OF THE FOREIGN BODY LOCATOR (BERMAN) IN INDUSTRIAL PRACTICE

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IN many industrial and manufacturing processes and particularly where hardened steel parts such as chisels, punches, dies, etc., are struck with a hammer, it is not an uncommon occurrence for flying pieces of steel to embed themselves deeply within the tissues of workers.

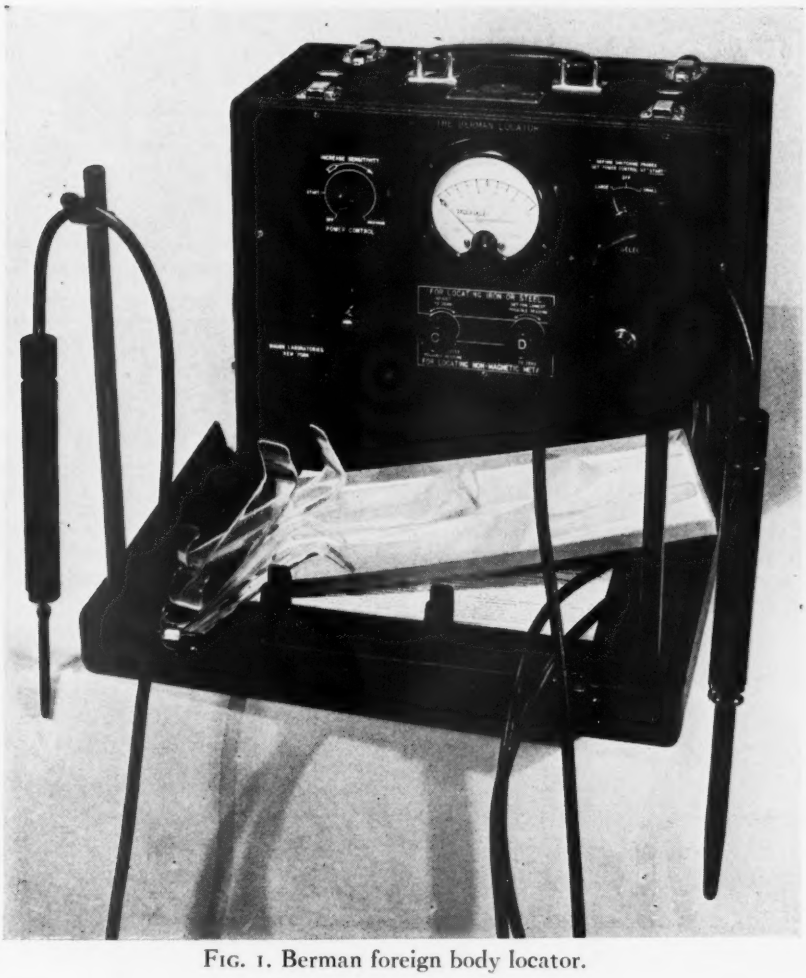
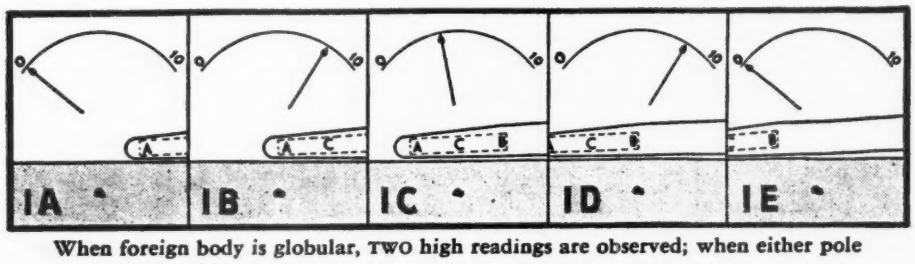


FIG. 1. Berman foreign body locator.

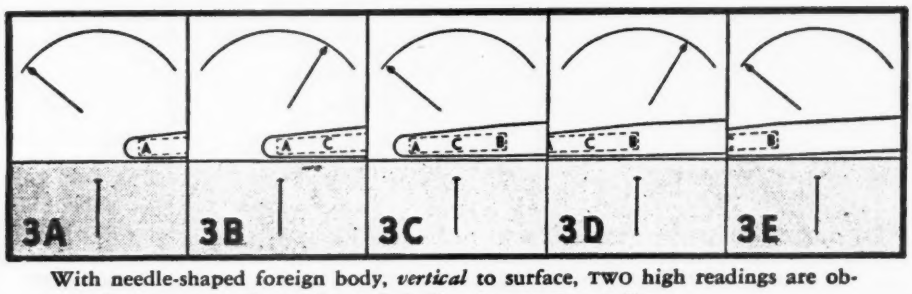
Whether to attempt the removal of such a foreign body or to advise against it depends of course upon the doctor's appraisal of the situation. In most cases, however, it is advisable to remove a foreign body because of the ever present possibility of subsequent irritation and complications even if the foreign body remains fixed in the tissues, which it usually does. On the other hand, migrating foreign bodies are by no means a myth and such possibility must be reckoned with.

The truth of the matter is that immediate removal of a foreign body would nearly always be advised were such removal

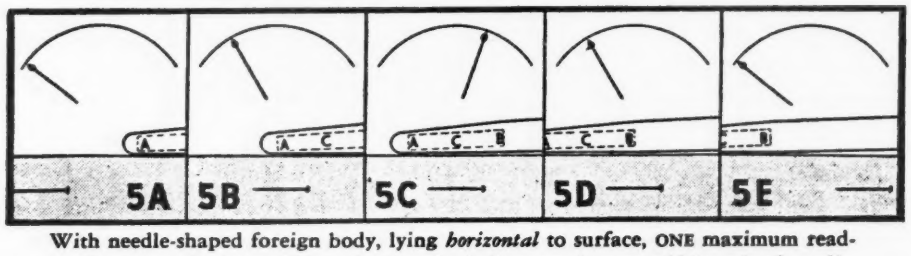
merely a routine surgical procedure involving no more than skill and conscientious effort on the part of the surgeon. Unfortunately, as all of us who have had any considerable experience with foreign bodies well known, such cases are far from being routine matters, are full of uncertainties and when attempted with only the customary *x*-ray localization, the search is often a prolonged, tedious matter and is apt to end in unexpected failure in a large percentage of cases despite the most accurate and painstaking work on the part of the radiologist. The difficulty of perfect interpretation of the *x*-ray plate for obtaining a correct surface localization, the possibility of a shifting of the foreign body with respect to the skeleton due to a slightly different position of the patient between the *x*-ray room and the operating room, the movement of the tissues by the surgeon's own manipulations during the operation and the hesitancy on the part of the careful surgeon to incise an important structure unless he knows beyond doubt that the fragment is actually there, all contribute to the uncertainty of the final outcome of such a case. At times, one will resort to the fluoroscope, but this procedure has many drawbacks, not the least of which is the danger of *x*-ray burns from repeated exposure of the hands to the rays.



When foreign body is globular, TWO high readings are observed; when either pole is over the particle.



With needle-shaped foreign body, *vertical* to surface, TWO high readings are observed; these occur when either pole is directly over the needle.



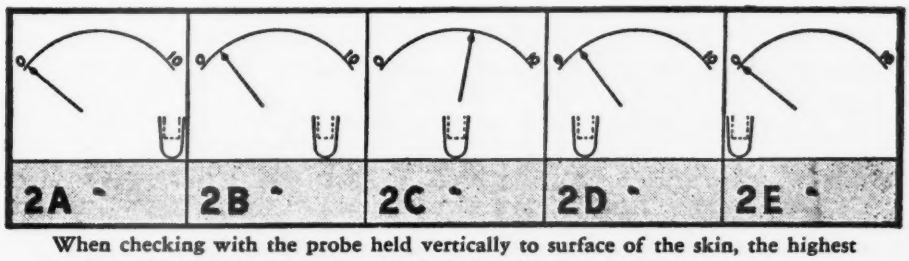
With needle-shaped foreign body, lying *horizontal* to surface, ONE maximum reading is observed when mid-length of probe inductance is over mid-length of needle.

FIG. 2. Various readings of different shapes of foreign bodies.

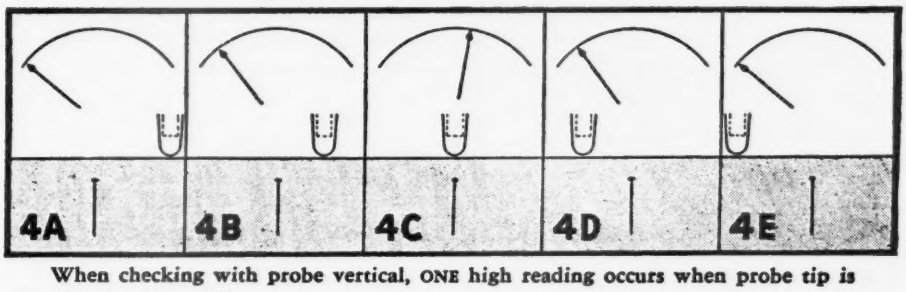
It was, therefore, with a great deal of interest that I read in the January 9, 1943, issue of the *Journal of the American Medical Association*, the paper by Dr. John J. Moorhead, of New York, describing the foreign body locator that was devised for him by Samuel Berman, then on the engineering staff of the New York City Transit System.

I was frankly skeptical about the possibilities of such a device until I received a case (Case IV) which was obviously difficult and delicate in nature. Upon my request, Dr. Moorhead removed this foreign body with the aid of the Locator. That demonstration was so impressive that I at once took steps to obtain such an instrument for use by the medical staff of our plant. I have now had the instrument for more than four months and, with its aid, have completed a sufficient number of foreign body cases to form some definite conclusions concerning its value.

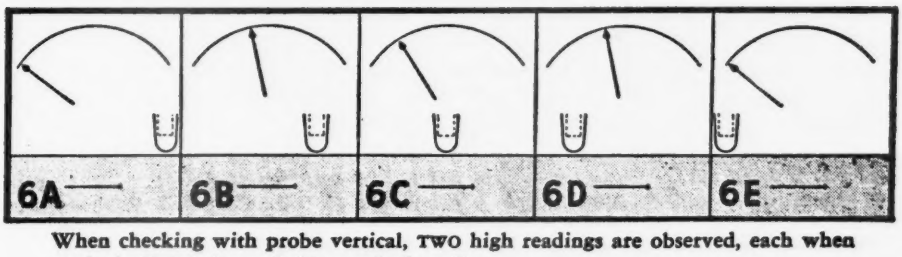
The first outstanding fact is that I have not had a single failure since the acquisition of the Locator, in sharp contrast to a record of about 50 per cent failures previously. I can think of no more embarrassing situation for the physician than, after working on a patient for an hour or an hour and a half, to have to give up and announce to the patient that he could not find the foreign body. In a large plant where impressions of the medical facilities and personnel are widely circulated very rapidly, occurrences of such failures are definitely detrimental to medical-employe relation. The layman just cannot understand why a doctor should not easily find a foreign body when he has an *x*-ray which shows him "exactly" where it is.



When checking with the probe held vertically to surface of the skin, the highest reading will be observed when probe tip is directly over particle.



When checking with probe vertical, ONE high reading occurs when probe tip is directly over needle.



When checking with probe vertical, TWO high readings are observed, each when probe is slightly beyond either end of needle.

FIG. 2. See legend on opposite page.

The use of the Locator has changed the picture so completely that instead of viewing the prospect of a foreign body case with distaste and considerable misgiving, I now actually look forward to such cases with a certain degree of pleasure.

Contrary to expectations, I find the machine extremely easy to handle and operate and a very small amount of

practice sufficed to acquire proficiency in its use. (Fig. 1.)

Briefly, the principle upon which the Locator operates is what is known as "electromagnetic induction." Detection takes place at some distance and contact with the foreign body is not at all required. The Locator does not possess any magnetic force for removing the foreign body. It merely detects its presence and accurately localizes it. It is most effective for iron and steel although it also has a slight sensitivity to other metals such as copper, aluminum, lead, etc. Its range of effectiveness is dependent upon the size of the fragment with a maximum of about four inches for the very large pieces and an average of about one inch for the average sized small foreign body of iron or steel encountered in industrial work. An iron pinhead (about 2 mm. in diameter) is detected from a distance of about one-half inch.

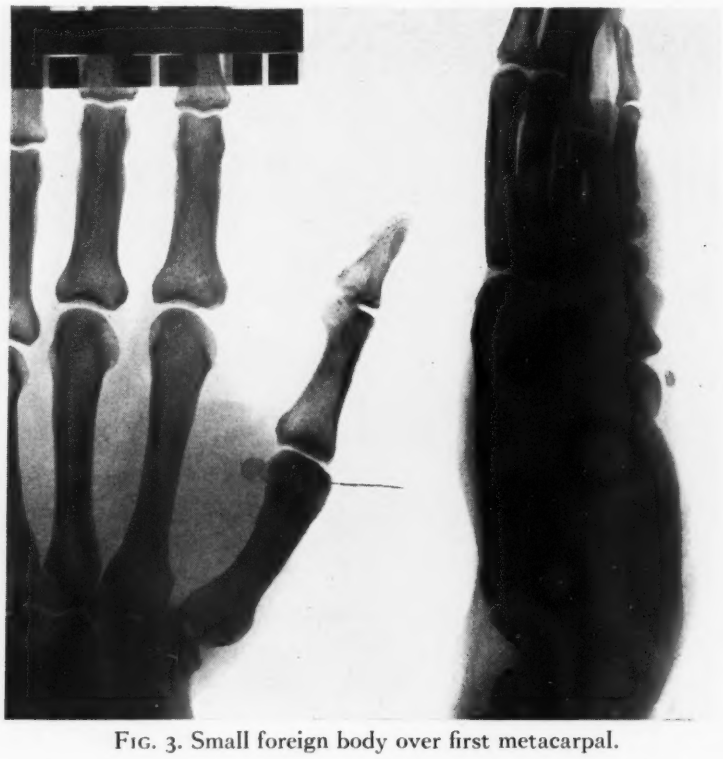


FIG. 3. Small foreign body over first metacarpal.

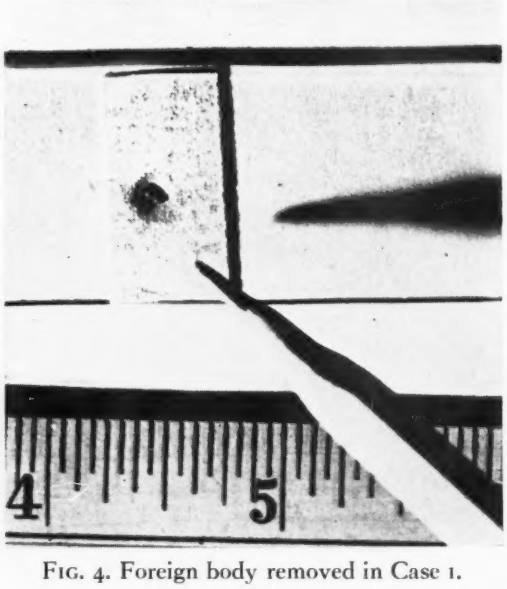


FIG. 4. Foreign body removed in Case 1.

The Locator has two probes (large and small) connected by flexible cables to the power unit. These probes are identical in action and differ only in size and sensitivity. The large probe is used mainly for preliminary surface localization and the small one is used for localization within the wound itself.

Localization is accomplished by moving the tip of the sensitive probe about the suspected area and observing the indica-

tion of the indicating meter on the panel of the power unit. The tip of the probe is closest to the foreign body where the highest reading is obtained.

A B

Fig. 5. A, foreign body in region of left shoulder; B, *x*-ray taken three months later shows no evidence of foreign body.

The usual procedure is first to examine the patient with the large probe and determine the correct surface localization which is marked with some indelible marker. A depth estimate is then obtained by observing the meter reading at the marked spot and then selecting a sample piece of metal matching the foreign body as closely as possible in dimension and composition. The dimension of the matching sample is of course determined from the appearance of the foreign body on the *x*-ray plate. The matching sample is then brought close to the proble until the same reading is obtained as was previously noted over the surface localization on the patient's body. The distance at which this reading is obtained is a very close approximation of the subsurface depth of the foreign body. Then, while the patient is being prepared, a sterile rubber sheath is placed over the probe (usually the small one) and if the surgeon does not at once discover the foreign body, it is readily relocalized within the wound itself so that the surgeon may proceed in the correct direction. For best results, frequent alternation between the knife and the probe is advised. An important step in the procedure is to reinsert the probe within the wound after the foreign body has been removed, to check whether or not all of it has been removed. For this final check, the probe is used at maximum sensitivity. (Fig. 2.)

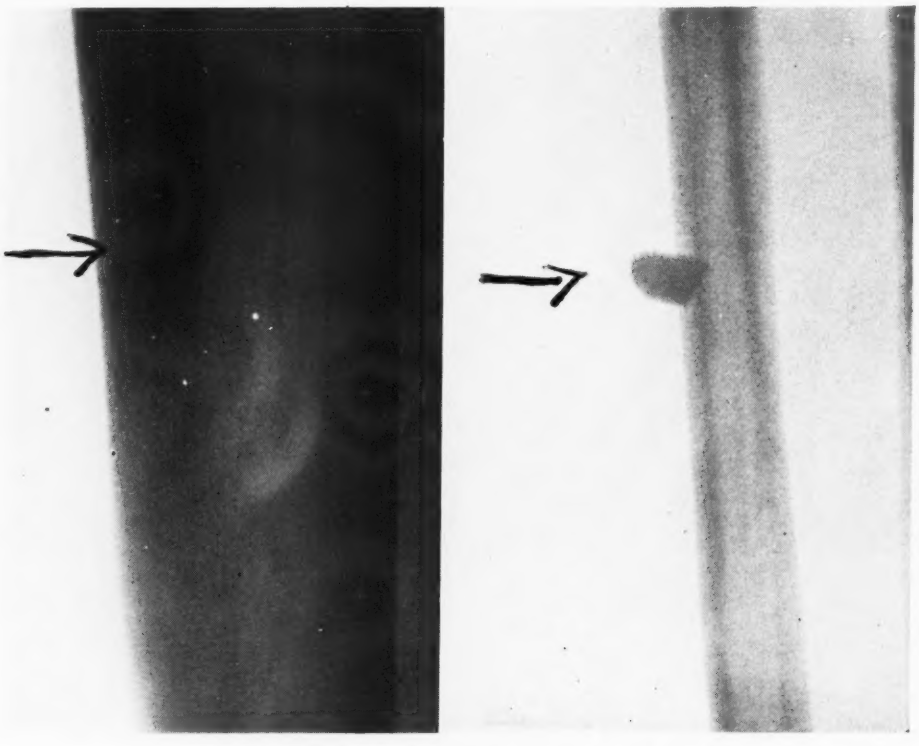
There are several points in the operation of the Locator that I wish to emphasize:

1. It is essential that a suitable person other than the operating surgeon be thoroughly trained in its use. Except in emergency, it is not practical to operate the machine and perform surgery at the same time. In our plant, one of nurses manipulates the machine while I perform the surgery.

2. Thorough familiarization with the operation of the machine and a reasonable time spent in practicing the finding of small bodies embedded in a suitable opaque medium (modelling clay has been found ideal) is necessary. The first successful case will more than repay one for the effort thus put in. The Locator is a remarkably sensitive instrument and its full possibilities should be capitalized upon.

3. It is important that a minimum of force be applied when using the probe

within the wound for two reasons: (1) The probe is sensitive to sidewise pressure and excessive force may deflect the internal sensitive element sufficiently to affect the meter reading; (2) some foreign bodies, especially needles, may be pushed deeper into the tissues by unnecessary pressure.



A B

FIG. 6. Foreign body, mid-portion of right tibia.

4. Good assistance is required in the surgical procedure. The high accuracy of the Locator ordinarily makes palpation unnecessary and superfluous, but requires good surgical technic with careful dissecting and hemostasis and everything being done to facilitate visual inspection. Since metal instruments cannot be left in the field when the probe is used, vessels must be tied off, instruments removed, and non-metallic retractors used. For small shallow incisions, sutures are best for retraction.

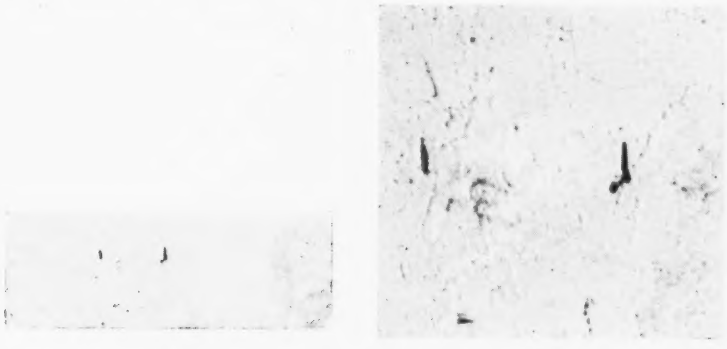
5. Very often the Locator will indicate a direction of the foreign body which the surgeon will hesitate to explore. Experience has shown the Locator to be invariably correct in its indications, and the surgeon is encouraged to follow its direction unless there are definite reasons to the contrary. Case 1 will illustrate this.

The following are illustrations of some of the cases I have done:

CASE 1. This man had a foreign body enter the region just proximal to the metacarpal phalangeal joint of the thumb. I accurately localized the fragment and proceeded with its removal. The Locator led me to a point just over the extensor tendon of the thumb, and yet I could see no sign of a foreign body. This being the first case in which I attempted to use the Locator on my own, I was afraid that I was misinterpreting its indications, and hesitated to incise the tendon. I closed the wound again, feeling rather disappointed. I promptly called Mr. Berman, the inventor of the device, who volunteered to come out and assist me with a second attempt. Mr. Berman's localization agreed exactly with my own and I went through the original incision until I reached the identical spot where I had stopped the previous time. The foreign body was directly beneath the tip of the probe although

there was absolutely nothing to indicate that a foreign body had entered there.

I opened the tendon and to my amazement found the foreign body directly within its substance. In my mind, I do not think this foreign body would ever have been found by any other method and this man would undoubtedly have had interference with the function of the thumb on account of this foreign body, had it not been removed. (Figs. 3 and 4.)



A B

Fig. 7. A, actual size of foreign body removed in Case v; B, same foreign body magnified ten times.

This illustrates two important things: First, that the prospective user must learn the correct use of the machine and practice sufficiently to have confidence in the correctness of his interpretations; secondly, that feeling certain of his interpretations, he may rely upon the indications of the Locator with complete confidence.

Case ii. This case merely illustrates the fact that foreign bodies do move in tissues. *X*-ray picture on the left shows foreign body to be present in the left shoulder area. This *x*-ray was taken before I had the machine. Subsequent *x*-ray on right reveals no evidence of foreign body. Where the foreign body went, I had no idea. *X*-rays of the chest were taken and it still was not found. The danger of the foreign body's moving is greater, of course, in proportion to the small size of the object. The smaller the foreign body, the more apt it is to move. (Fig. 5.)

Case iii. This case is interesting in that it remarkably demonstrated the value of this machine. The foreign body as can be seen in the *x*-rays, is rather a large one and made a wound of about ¾ inch long. Surface localization with the large probe over the wound of entry revealed no reading whatsoever. The probe was passed over the surface of the leg and a maximum reading was obtained three inches below the site of the wound. An incision was made over the area where the locator gave a maximum reading and the foreign body was found without any difficulty. (Fig. 6.)

Case iv. This man had a piece of steel in the substance of the thyroid gland. With the aid of the Locator throughout, a 1½ inch incision a piece of steel about ⅜ inch long and ⅛ inch thick was removed. This was done by Dr. Moorhead, at the Post-Graduate Hospital before I obtained the machine. The operation was done with a minimum amount of trauma and disturbance to the thyroid and was an impressive demonstration of the value of the Locator.

Case v. This case illustrates the extreme sensitivity of the machine in that it enabled us to extract a sliver of steel, the thickness of a hair and ¼ inch long, from the tissues. Figure 7 is a reproduction of the steel removed. The sliver is almost too fine to be visualized by *x*-ray and I was not sure whether there was anything in the tissues or not. Surface localization with the large probe gave a reading indicating the presence of a foreign body. I made an incision and extracted the small piece on the right. To be sure that all the steel had been removed, I tested the area with the locator and again obtained a reading. I explored the wound further and extracted the piece on the left. I had not realized up to this time that such a small particle of steel would be recorded on the machine. This demonstrates the fine use that can be made of this apparatus. (Fig. 7.)

Since this time, we have utilized the machine in daily practice on patients who come in stating that they think they may have a steel splinter in their hands or fingers. Surface localization is attempted, and if there is a splinter present, no matter how small, it will give a reading. This saves the patient unnecessary probing and trauma to the tissues in attempting to remove splinters that are present.

Other cases completed with the aid of the Locator were routine in character and presented nothing unusual except that the foreign bodies were all quickly found without any difficulty. No purpose would be accomplished by reporting these in detail except to again illustrate the value of the Locator in this work.

SUMMARY

1. The use of the foreign body Locator in industrial practice is discussed with its applications.

2. Practical points in its use are mentioned.

3. Various, typical cases are illustrated.

CONCLUSION

I consider the Berman Foreign Body Locator indispensable in the treatment of foreign bodies. It has a wide application in industrial practice.

MUCH of the most important of vulvar tumors is carcinoma, which is the third most common of all gynecological cancers, being exceeded in frequency only by cancer of the uterus (cervix and corpus) and cancer of the ovary.

TREATMENT OF INFLAMMATORY URETHRAL STRICTURES

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THE treatment of urethral strictures is probably less well understood and treated with more ill advised confidence than any other serious body lesion. That strictures may produce urinary back pressure is presumably universally acknowledged, but it is the urologist that appreciates the actual ravages of a stricture for it is he who finally inherits the patient with his bladder and kidneys hopelessly exhausted. It is the purpose of this paper to outline a rapid and safe method for the non-operative treatment of small caliber inflammatory strictures. I mention urethral inflammatory strictures specifically since neglected traumatic strictures usually demand surgery and belong only in the hands of a competent urologic surgeon.

A urethral stricture of 22 F. caliber presents no profound therapeutic problem. This stricture is of moderate proportions and dilatations are undertaken at five-day intervals with metal sounds until the urethral caliber is normal and then gradually the dilatation interval is increased. However, instances in which the urethral caliber is no greater than filiform size constitutes the problem that is so often mishandled.

The introduction of the filiform through a stricture is accomplished by patience. Sometimes the use of a urethral blunt-nosed syringe filled with mineral oil is effective. The penis is held at the coronal sulcus between the first and second fingers of the left hand and the mineral oil is injected slowly into the urethra. When its passage meets with obstruction gentle pressure is maintained until some of the oil slowly passes through the stricture. The urethral meatus is then compressed between the first and second fingers of the left hand and a filiform is gently introduced into the urethra until the obstruction is encountered. The filiform is repeatedly withdrawn slightly, twisted and re-introduced until the stricture is traversed. Gentleness is the secret of success in the introduction of a filiform and any other approach is rewarded with only trouble and tragedy. It is not unusual to spend fifteen to forty-five minutes or even longer in introducing a filiform through a stricture of small caliber. The use of oil will permit the passage of a filiform when other methods fail since the oil distends the stricture and thus straightens and lubricates the course of the stricture which is characteristically serpentine in contour. However, it is to be remembered that the introduction of oil plus rough handling may produce an oil embolus.

After the filiform has successfully traversed the stricture it is imperative that the filiform is not withdrawn, but that a Phillips catheter follower be attached and introduced into the bladder. The largest Phillips follower is attached that can be introduced into the bladder without marked discomfort to the patient. The Phillips catheter is strapped in position so that the vesical urine drainage is free and the attached filiform lies curled in the bladder. The patient is confined to bed. If the vesical retention is massive and chronic, gradual decompression is desirable. Fluids are forced and some urinary antiseptic administered. Urotropin is a particularly satisfactory urinary antiseptic

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for this purpose since there are no factors of toxicity or sensitivity to be considered. The maximum effectiveness is dependent upon a urine with a hydrogen ion concentration of 5 or less; hence, fruit juices are absolutely forbidden since they produce an alkaline ash. For short periods the usual sodium acid phosphate salt is effective in reducing the urine hydrogen ion concentration to the desired level. Furthermore, during the period of the inlying urethral catheters, it is essential that the bladder be thoroughly irrigated twice daily with at least 1,000 cc. of solution at each irrigation and the urethra must be thoroughly but gently flushed at each change of catheter. A 5 per cent lactic acid solution makes a very satisfactory solution for irrigation.

In hospitals where urologic surgery is not commonly done an apparatus for gradual vesical decompression is usually not available. This problem can be solved by inserting into the end of the bedside bottle tubing a Luer needle of 20 or 22 caliber and thus vesical emptying progresses slowly. The sterility of the bedside tube and bottle is essential and should be re-sterilized at intervals of twenty-four hours. The connection of the rubber tube and the Phillips catheter follower is most successfully accomplished by slipping the rubber tube over the expanded end of the Phillips follower rather than to attempt a union with a glass connector.

After the filiform and follower have been in position for twelve hours or at the most twenty-four hours, the penile strapping is removed and the follower pulled out of the urethra to the screw junction and a follower of two French sizes larger screwed in position, inserted into the bladder and re-strapped. It is important that the filiform be not removed from the bladder and only brought out to the meatus so that a larger follower catheter can be attached. The follower that has been retained for twenty-four hours is discarded since the urethral secretions and urine will have usually caused surface deterioration.

When larger urethral Phillips follower catheters are introduced it will be quite universally observed that the follower which is 2 F. sizes larger than the one removed will slip easily in position and on no occasion should a follower be used that binds at the stricture site. It will be the usual experience that increasingly larger followers can be introduced at twelve-hour intervals so that in a period of two days the urethral caliber can be increased from 12 to 18 F. or in three days to 22 F. This affords a remarkable amount of safe dilatation in a comparatively short time.

After the urethral stricture has been dilated with Phillips filiform and followers to 22 F. the follower with its filiform is removed and the urethra painstakingly washed out being particularly careful not to overdistend the urethra and thus spread the bacteria laden products of catheter irritation into the contiguous ducts and glands of the urethral mucous membrane. When the urethral irrigation fluid returns clear, a bevel edge soft rubber catheter of 20 F. size is introduced into the bladder, adjusted for free flow and strapped in position. A Foley retention catheter may be substituted for the bevel edge catheter since it has the added advantage of not requiring penile strapping. The same plan of increasing the size of the rubber catheter is followed as was done with the Phillips filiform and followers; that is, a rubber catheter of 2 F. sizes larger is introduced after each twelve-hour interval of urethral retention until a 26 F. catheter has been maintained in position for twelve hours.

It is wise to confine the patient for at least twelve hours following the removal of the last dilating catheter. The reason for this practice being that after the catheter is removed the urinary tract is transposed from an open to a closed system (its normal state) and this transition may be, on occasion, followed by a bout of fever, muscle pain and malaise. If this complication occurs, it is treated by introducing a urethral catheter, washing out the bladder, forcing fluids or administering intravenous

fluids. The intravenous fluid of choice is 5 per cent glucose in distilled water (instead of saline) so as not to place an additional burden of salt excretion on kidneys that may already have a minimum of reserve. With the above therapy the pyrexia usually subsides rapidly. On the other hand, if the symptoms continue or there is a reappearance of fever it is wise to seek the aid of a urologist for additional investigations of the patient's urinary tract.

When the final dilating catheter is removed it is a good practice to fill the bladder previously so that the patient may immediately void, upon withdrawal of the catheter. This is important particularly for psychological reasons, since it is not hard to see that a patient who has been straining to void a needle-size stream is considerably encouraged and pleased suddenly to experience an effortless normal urinary stream.

Resume. The following points constitute the routine in this method for dilatation of small inflammatory urethral strictures:

1. A urethral filiform is passed through the urethral stricture.

2. A Phillips follower catheter is attached to the filiform and inserted into the bladder for drainage and dilatation. If the stricture will not permit a Phillips catheter to pass, the filiform is fixed in position for twenty-four hours after which time a small Phillips catheter will usually traverse the stricture.

3. The bladder is to be decompressed slowly in the event of chronic massive retention. A simple method is outlined in the substance of the paper.

4. A urinary antiseptic should be administered during the course of dilatation.

5. The bladder should be washed with 1,000 cc. of some irrigating fluid twice daily and the urethra washed clean at each change of catheters.

6. The dilating catheter followers are increased 2 F. sizes every twelve hours until a Phillips catheter of 22 F. is reached.

7. After a 22 F. catheter follower is retained for twelve hours the follower and filiform is replaced with a 20 F. soft rubber bevel edge catheter.

8. The caliber of the rubber urethral catheter is increased 2 F. sizes every twelve hours until a 26 F. catheter has been maintained in the strictured area for twelve hours.

9. The patient is then treated with urethral dilatations by metal sounds at intervals of two days at first and the interval is gradually increased as it is noted that there is no intervening diminution in the caliber of the urethra at the original stricture site.

In conclusion, it is to be emphasized that a malignancy of the urethra must be suspected in any stricture, irrespective of its apparent etiology, which does not respond to dilatation and particularly if repeated dilatations are accompanied with profuse urethral bleeding. Such an individual is entitled to a careful diagnostic study by a competent urologist.

SUMMARY

A rapid, safe and long tried non-surgical method for treating small caliber inflammatory urethral strictures is presented for the benefit of the general practitioner and those not especially trained in the treatment of urological conditions.

PILONIDAL SINUSES AND CYSTS*

A RECOMMENDED METHOD OF TREATMENT

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PILONIDAL sinuses of the coccyx are being encountered with surprising frequency among the fighting forces. It is the men in combat areas who are missed most as a result of this disabling condition. The comparative effect is even greater when one stops to realize that members of the Mongolian race have always been considered to be free from this disease. Negroes rarely are so affected, and the American Indian exhibits the condition rarely or not at all.

The incidence of this disease in the armed forces of the United States, although impossible to determine accurately at this time, is certainly high, chiefly because one deals with males who fall into that age group in which such occurrences are noted most frequently. The number of man-days lost while on the sick list for this condition varies from about seventy to as many as 200+ days, with an average of about three months. Were it possible to combine the figure for true incidence with this period of disability an astounding figure for "fighting days" lost would be revealed. DePrizio[1] has estimated the incidence at one station hospital to be 1 per cent of the total personnel.

The recurrence rate is also very high. The method of treatment seems to influence this rate so that the exact recurrence is difficult to determine, but it is variously given as from 19 per cent (the lowest record found excepting one report of no recurrences) to 33 per cent in selected cases with primary closure.

DEFINITION

Before dealing with the recommended methods of treatment, it is necessary to deal briefly with the definition and theories of these teratomatous cysts. Of the many terms which have been applied, "pilonidal cyst" is the most common. Late studies as to the origin have introduced terms which are based, more or less, on embryological development. By definition, these are epithelial-lined cysts (often merely sinuses) of congenital origin occurring in the skin overlying the sacrococcygeal region, superficial to the bone, and in, or adjacent to, the midline. It is this definition upon which the recommended method of treatment has been based.

The symptoms, signs, diagnosis, and differential diagnosis will not be discussed here since articles may be found in any standard work dealing with the subject.

ETIOLOGY

From a study of the available literature it appears that the condition was first described by Warren[2] in 1867. No mention was made at that time of its origin. Scientific curiosity as to its origin was aroused slowly, and it was not until about 1882 that Lannelongue[3] advanced the theory that it was a process of ectodermal invagination due to faulty skin agglutination of the sacrococcygeal region. In 1887, Tourneux and Herrman[4] advanced the theory that these cysts originated from a persistence of coccygeal vestiges of the neural canal. These two theories have evoked considerable controversy. Mallory,[5] in 1892, strongly supported the neural canal origin. Further impetus was given to the support of this theory by Moise,[6] in 1926, and by Ripley and Thompson,[7] in 1928, when they described cases in which a connection existed with the neural canal

* The opinions and/or assertions contained herein are the private ones of the writers, and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

and was the source of meningitis. In 1934, Stone[8] advanced his idea that these pilonidal cysts arose from a vestigial structure analogous to the Preen's gland of birds. There has been a general lack of support of this belief. In 1935, Fox,[9] following studies of the human embryo, gave support to the invagination theory. He concluded that this invagination occurred during the third and fourth months of embryonic life from cells destined to form appendages as hair and glands.

After a review of the available data on the embryological development of structures in this area, the authors believe that the persistence of the neural canal remnants accounts for the condition only in those rare instances in which a sinus tract is found extending beneath the sacrum and coccyx, and that the majority occur merely as a result of the invagination of ectoderm.

It is not believed that trauma produces the condition, but only accentuates it by causing: (1) infection, (2) the stimulus for increase of secretion from the enclosed sebaceous and sweat glands in an area prolific with hair follicles, sebaceous and sweat glands, and (3) blockage of the original sinus tract communicating with the outside from resulting edema and excoriation of the epithelium, and, perhaps, by actual occlusion of the sinus by direct union of the edges. Credence is given this view from the fact that these cysts contain grumous, buttery material, and that on microscopic examination they are found to be lined with ectoderm, but without any mixed elements in the surrounding tissues. Almost invariably infection is present and often pus obscures the remaining contents. In addition, it is believed that these cysts are at first rather small or exist only as sinus tracts, and become large or even huge in size as a result of filling and stretching, with small ruptures into neighboring normal tissue, followed by burrowing sinuses which later become epithelialized from the parent cyst and persist as daughter cysts.

RECENT TRENDS IN TREATMENT

Without fail all articles reviewed stress three basic principles as regards treatment: (1) Treatment of the infection before surgery is performed; (2) the successful removal or eradication of the cyst and all its tracts; and (3) subsequent healing of the wound. It has been a universal axiom that in all cases in which the cyst is infected drainage should be established and measures employed to combat the infection for some ten days to two weeks before any operative procedure is carried out.

There is complete agreement as to the absolute necessity of observing the first and second of these principles, and the different forms of treatment have evolved in an attempt to increase the speed and effectiveness with which the third principle could be accomplished. It is largely with the first and second principles that the proposed method of treatment takes variance. It has also resulted in a distinct lessening of the time required in attaining the desired third principle.

A few of the recent methods of treatment will be mentioned briefly. Further details may be obtained by consulting the references. Colp[10] advocated primary closure wherever possible, depending upon the amount of previous infection, proximity to the rectum, and the ability to obliterate dead space. Tendler[11] performed primary closure in approximately 20 per cent of a series of eighty-seven cases, of which one-third broke down or became deeply infected. Camp and Polites[12] reported excellent results with primary closure in twenty-two cases with no recurrence, and essentially primary healing in fifteen other patients still in the hospital. The total hospitalization for these cases, however, averaged forty-five days, due in part to the time required for preoperative conditioning of the patient. Their "no closure" cases average seventy-four days for eight cases, and the "partial closure" cases averaged ninety-three days for four cases. No other series has been found in which

such excellent results with primary closure are reported.

Several methods have been advocated for partial closure of the wound in an effort to speed recovery. DePrizio[1] removed the sinus by undercutting the skin edges, removing the sinus and excess fat, and then suturing the skin flap down into the wound. In his cases, closures were affected in slightly less than five weeks. Brezin[13] described a method of reflecting a pedicle skin graft from above the sinus and using that flap to close the defect completely or partially. He reported that healing occurred in twenty-six days by this method. In this category also falls the standard and well known "Lahey flap" method.

The number of authors advocating complete removal and no closure constitutes by far the majority. Most surgeons prefer to accomplish the removal of the tract and sinuses by sharp dissection with the knife or with the electrosurgical unit. On the other hand, there have been some reports of good results accomplished by destroying the sinus wall and sinuses with a sclerosing solution. Among the outstanding champions of this method have been Cutler and Zollinger,[14] and Block and Green,[15] who reported favorable results with Carnoy's solution or modifications of it. Swinton and Hodge[16] went further by excising in a block dissection and using modified Carnoy's solution dressings for a short while.

The main factors which caused a search for a new form of treatment were: (1) that no operation had been found which was satisfactory in preventing recurrences or avoiding a long period of hospitalization in the majority of the cases; and (2) a study of the origin of these sinuses resulted in the opinion that the ectodermal lining could be utilized in covering the defect and permitting free drainage of the products of the sweat and sebaceous glands contained therein. The procedure to be outlined can be carried out in the presence of infection. This eliminates the long preoperative stay on the sick list. The procedure is very simple and can be done aboard any ship, whether it be a destroyer or a larger vessel, with only a few days lost from work.

PRESENT PROCEDURE

Since a thorough review of the literature cannot be carried out at this time, no claim of originality is made for this procedure. In a discussion of this method, one surgeon remarked to the authors that the same or a similar procedure had been carried out at the Mayo Clinic. The authors regret deeply that they are unable to locate this or possibly other articles in order to give proper credit where it belongs.

The patient may be operated upon in the presence of marked infection so that no extended preoperative preparation is necessary. The usual field preparation is done and the patient is given morphine sulfate, $\frac{1}{4}$ with atropine sulfate, gr. $\frac{1}{150}$ about forty-five to 60 minutes before surgery is to be performed. At the time of operation, Bearse straps of adhesive tape are applied to pull the buttocks apart and the anus is protected with gauze or cotton. The routine skin preparation is carried out. Procaine solution, 1 or 2 per cent, is injected into the skin and subcutaneous tissues about, but clear of, the area of redness, and extending down deeply enough to block the field. After about five minutes an incision is made in the midline over the most prominent part of the cyst. When the cyst is entered, pus or grumous material will exude, depending upon the amount of infection and collected débris. When this material has been removed from the cyst, the incision is extended the full length of the cyst (Fig. 1) and any sinus tracts are opened to the surface in the same manner. If there are over-hanging edges, these are trimmed away. (Fig. 2.) The entire cyst and tracts are wiped out well with dry gauze. A small curette or a large rounded knife blade is used to curette away the dead, superficial layer of the cyst wall. This having been accomplished,

a thorough inspection is made for other sinuses which may have been missed previously, and, if found, they are opened

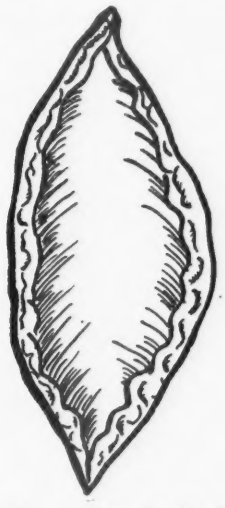

Fig. 1. Longitudinal section showing cyst open.

in a similar manner and curetted. After all visible tracts have been opened and curetted, a wedge-shaped piece of tissue is removed from between the cyst wall and the cut skin edges (Fig. 3) all around so that the skin edges and the cyst wall will approximate without any tension. (Fig. 4.) The wedge is carried only as deep as is necessary for the purpose. Fine Babcock stainless steel wire on a half-circle cutting needle is preferable as it is non-capillary, although silk, linen, cotton, and dermal sutures could be used. Closure of the skin to the cyst wall is accomplished with a continuous suture. A small amount of vaseline gauze covered by dry dressings is applied and held in place with a "T" binder. The patient is usually allowed to walk back to his bunk.

Morphine is given to relieve pain during the first twenty-four hours but more than two doses are seldom needed. Beginning on the first postoperative day (but not on the day of operation) the patient is started on a course of hot sitz baths, given thrice daily, followed by the original type of dressing. This program is continued for one week and then only twice daily thereafter. The sutures are removed seventy-two hours after the operation when wire is used as it tends to become imbedded and the skin heals over it, making its removal

Fig. 2.

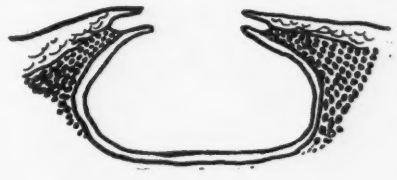

Fig. 3.

Fig. 4.

Fig. 2. Cross section showing overhanging edges cut away.

Fig. 3. Cross section after wedge has been removed between skin and cyst wall.

Fig. 4. Cross section showing skin edge united to cyst wall.

difficult at times. Other types of sutures may be left in longer, but as there is very little tension on these it is seldom necessary. As soon as the sutures are removed the patients are allowed to return to duty and are instructed to return to the sick bay for the hot sitz baths and dressings.

RESULTS

The senior author has used this method for three years. The earlier patients who were operated upon aboard one of our hospital ships were given cards to be returned in case of recurrence. Thus far, no cards have been received, nor did any patient return to the hospital ship with recurrence. Three patients operated upon by this method when it was first employed have been interviewed recently and are in excellent condition and have not had any further trouble. All patients operated upon similarly during the past year are

still under observation and appear to be completely cured. Due to war conditions the special case records kept on these cases are not available for individual tabulation, except for those patients who were operated upon during the past year. Therefore, the exact number of cases in which this procedure has been done cannot be stated but it is estimated conservatively at between seventy-five and one hundred. The average time for patients to remain on the hospital ship was between three and four weeks. This period of hospitalization was only in keeping with the policy of obtaining complete healing, or practically so, before returning the patients to duty. Even so, after three days all were placed on working details. This has been the practice also with the more recent cases. There have been no cases of spreading infection and bleeding has been minimal, seldom necessitating the use of ligatures.

FIG. 5. Case I. Scar eleven months old; complete healing eighteen days after operation; sick five days.

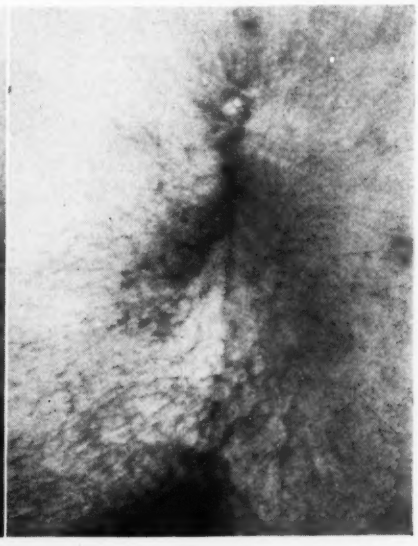

FIG. 6. Case V. Scar five weeks old; complete healing fifteen days after operation; sick three days.

FIG. 7. Case VI. Scar five weeks old; complete healing fifteen days after operation; sick three days.

FIG. 8. Case VII. Scar ten days old; not completely healed at top and lower left; sick three days.

In civilian practice most patients could return to work after three or four days as they are allowed to do when operated aboard ship. It will be found that during the healing stage pain is extremely rare.

COMMENTS

As previously mentioned, this method is directly opposed to the staunchly supported principles in the treatment of this condition; these are complete removal of the sinus and tracts, and the eradication of infection and the establishment of drainage, if necessary, before operation was done. The latter practices usually required about two weeks of preliminary care, since the cyst cannot be opened and the patient be permitted to return to duty and be advised to return for operation later, since a flare-up is the rule during the preoperative interval. The procedure employed by the authors certainly accomplishes adequate drainage and instead of attempting to remove the wall of the sinus and tracts, it is utilized to re-epithelialize the defect. Granulations are relatively few; the scar is much smaller than the original defect, and the new skin appears tougher than an ordinary scar.

Invariably the question is asked, "What about other sinus tracts which may be missed?" There are two possible reasons why such sinuses apparently cause no trouble: first, most patients are operated upon when the cyst is well distended or soon thereafter, so that probably all sinuses are opened enough to be visualized at the time of the operation; and second, by permitting these sinuses to have an undisturbed opening onto the surface they have free drainage, and thus will cause no trouble. This belief is predicated on the fact that drainage of the parent cyst is always followed by relief from symptoms and infection, showing that the tracts, when allowed free drainage, are symptomless and are usually free of acute infection. Removal by sclerosing methods or by dissecting across the tracts may result in healing over and sealing of the tracts, thus allowing a repetition of the original process. In other words, it is believed that by replacing this tissue on the outside of the body where it belongs it will behave in a normal way. Time alone will tell if this assumption is correct.

Another question frequently asked is, "What about those sinuses which extend beneath the sacrum and coccyx?" Thus far the opportunity has not been afforded to treat one of these by this method. These are occasional cases in which the sinus possibly arises from remnants of the neural canal. It is believed that by removing the coccyx and opening this tract up as far as possible or throughout its entirety that the results would be equally satisfactory since free drainage would then be afforded.

SUMMARY

1. The incidence of pilonidal sinus is three times more common in males than in females of the age group of greatest usefulness for military service. The incidence in military and naval personnel is high. It is rare in the negro and among American Indians and has not been described in the Mongolian race. The number of man-days lost at present is of tremendous import to the service.

2. These structures are best defined as epithelial-lined sinuses of congenital origin, occurring over the sacrococcygeal region, superficial to the bone, and in, or adjacent to, the midline.

3. Three theories of origin are discussed. They are: (1) invagination of the surface epithelium, (2) remnants of the obliterated neural canal, and (3) an analogue of Preen's glands in birds.

4. The general trends in treatment as usually practiced are based on: (1) complete removal or eradication of the sinus and tracts, (2) healing of the wound, and (3) preoperative care and treatment of the infection. Various types of procedures to accomplish these results are discussed briefly.

5. The reasons for developing a new type of treatment were: (1) none of the

operations in common use satisfactorily prevents recurrences or long hospitalization in the majority of cases; and (2) the nature of the origin of the sinus provided a clue as to a simpler and more certain method of treatment. The operation can be carried out without a long preoperative stay on the sick list. It is simple and can be carried out aboard any ship, of destroyer size or larger, with only about three days lost from duty.

6. The method described consists in thorough opening of cyst and tracts with marsupialization of the cyst wall to fill the defect. It can be carried out in the presence of heavy infection. Bleeding is minimal, no spread of infection occurs and healing is rapid and relatively painless.

The senior author wishes to express his sincere appreciation for valuable suggestions made by the late Captain E. A. M. Gendreau, (MC), U. S. Navy. The authors also wish to express grateful thanks to Captain John E. Porter, (MC), U. S. Navy for allowing the procedure to be carried out at U. S. Naval Base Hospital No. 2; and to Lieutenant (jg) N. R. Girault, U.S.N.R., for the drawings.

REFERENCES

1. DePrizio, Carl J. Pilonidal cyst and new improved type operation. *Military Surgeon*, 91: 292, 1942.
2. Warren, J. M. Surgical Observations. P. 192. Boston, 1867. Ticknor and Fields.
3. Lannelongue. Quoted by Picket, Wm. J. and Beatty, Arch J. Pilonidal cysts in the army. *Am. J. Surg.*, 56: 375, 1942.
4. Torneux and Herrmann. Quoted by Picket, Wm. J. and Beatty, Arch J. Pilonidal cysts in the army. *Am. J. Surg.*, 56: 375, 1942.
5. Mallory, F. B., Sarcorcoccygeal dimples, sinuses, and cysts. *Am. J. Med. Sc.*, 103: 263, 1892.
6. Moise, T. S., Staphylococcus meningitis, secondary to a congenital sacral sinus. *Surg., Gynec. & Obst.*, 42: 394, 1926.
7. Ripley, W. and Thompson, D. C. Pilonidal sinus as a route of infection in a case of staphylococcus meningitis. *Am. Dis. Child.*, 36: 785, 1928.
8. Stone, H. B. The origin of pilonidal cysts. *Ann. Surg.*, 99: 585, 1934.
9. Fox, S. L. The origin of pilonidal sinus. *Surg., Gynec. & Obst.*, 60: 137, 1935.
10. Colp, R. Treatment of Pilonidal cysts and Fistulae. *Surg. Clin. North America*, 9: 695, 1929.
11. Tendler, Morton J. Pilonidal sinus. *South. M. J.*, 34: 1156, 1941.
12. Camp, Milton N. and Polites, Nicholas. Symptomatic pilonidal cyst: operative treatment. *Am. J. Surg.*, 59: 541, 1943.
13. Brezin, David. Pilonidal cyst: report of a new procedure for operation and treatment. *Am. J. Surg.*, 59: 18, 1943.
14. Cutler, E. C. and Zollinger, R. Sclerosing solutions in the treatment of cysts and fistulae. *Am. J. Surg.*, 19: 411, 1933.
15. Block, L. H. and Green, B. L. Pilonidal sinus: sclerosing method of treatment. *Arch. Surg.*, 37: 112, 1938.
16. Swinton, N. W. and Hodge, C. C. The treatment of pilonidal sinus. *Surg. Clin. North America*, 19: 699, 1939.

THE USE OF TYROTHRICIN IN THE TREATMENT OF ULCERS OF THE SKIN

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AN excellent contribution to the list of substances possessing antibacterial action was made by Dubos in 1939 when he first isolated an extract from Bacillus brevis, a gram-positive aerobic spore forming soil bacterium. This extract, consisting of at least two substances, gramicidin and tyrocidin, was the result of two years of study and is known as Tyrothricin.

Since 1939 various articles have appeared in the literature on the experimental work, the chemical properties, the toxicity, the hemolytic effect, and methods of use. It seems that the consensus of opinion is that Tyrothricin is ineffective when administered orally, that it exerts no effect unless it can come in direct contact with the organisms, is ineffective and very dangerous when given intravenously, and that it should be administered only locally. Because of this, its field of usefulness so far is very limited. Reports show it to be of value in the treatment of mastoiditis, empyema, suppurating arthritis and deep wound infections. Charles H. Rammelkamp, in 1942, reported upon twelve patients with localized ulcers treated with Tyrothricin with good results in nine cases. While all the cases in the literature speak of the action of Tyrothricin on the bacteria in the ulcer, no mention has been made of one property that I noticed in five of the six patients treated, namely, tissue stimulation. I have treated six patients with very bad ulcers of the lower leg using Tyrothricin with excellent results in five of the six cases.

CASE REPORTS

CASE I. A female child, J. M., age five, white, was admitted to the Delaware County Hospital on December 17, 1943, with a large ulcer of foot following trauma. There was very little improvement from usual applications and from rest in bed. On January 10, 1944, Tyrothricin was started locally. The treatment consisted of compresses of gauze kept moist with Tyrothricin using 0.25 cc. of Tyrothricin to 99.75 cc. of sterile distilled water. On January 22, 1944, twelve days later, the ulcer was entirely healed and the patient was discharged.

CASE II. A male child, J. W., age four, white, was admitted to Delaware County Hospital on July 11, 1943, with extensive third degree burns of the right leg. The burn was treated with tannic acid and after the eschar was removed, there was a large amount of pus present and very little granulation tissue. Various applications of saline were used with only slight improvement. On September 17, 1943, Tyrothricin was started using the same treatment as in Case I. Granulations rapidly developed and on October 7, 1943, a skin graft was done. On October 23, 1943, the patient was discharged with the burned area entirely healed.

CASE III. A white girl, D. G., age fifteen, was admitted to Delaware County Hospital on August 30, 1943, with an old, unhealed area, the result of a burn two years before. The same method of treatment with Tyrothricin was carried out, but by September 23, 1943, there was no apparent improvement in the ulcer so the patient was discharged. The Wassermann test was negative.

CASE IV. A white man, D. B., age thirty-seven, had had an ulcer of the lower left leg for fifteen months. He was a druggist and so had access to all kinds of salves, ointments and various drugs. He had been to several physicians who had injected his veins on several occasions but without any apparent improvement. The ulcer, 1¼ inches in diameter, was causing a lot of pain and discomfort and interfered with his work. His Wassermann test was negative. He was instructed in the method

of treatment and on December 6, 1943, treatment as in Case 1 was started. Three weeks later there was marked improvement and on January 17, 1944, the ulcer was healed and the patient was discharged. Two months later the ulcer was still healed.

Case v. A white woman, R. W., age forty-nine, was seen in my office on November 4, 1943, suffering with a large ulcer with necrotic edges and 2 inches in diameter, on the medial side of the left lower leg. This ulcer had been present for ten months and she had been treated by several physicians using various forms of ointments, powders and dressings. She had also been in a good hospital for three weeks with absolute rest in bed. She had had various injections in her veins, but in spite of the treatment the ulcer had progressed. She was complaining of severe pain in her leg and was unable to do her housework, being able to be on her feet only a short time during the day. She was admitted to the Delaware County Hospital on November 11, 1943, and treatment, as outlined in Case 1 was carried out. Her Wassermann test was negative. On December 1st, she was allowed out of bed and was discharged healed on December 4, 1943. On April 1, 1944, the patient was in excellent condition, the ulcer was still healed, she was not suffering any pain, and was able to do all of her work.

Case vi. A white woman, M. B., age sixty-four, was admitted to the Delaware County Hospital on December 17, 1943, with a very interesting history. Her home was in Washington, D. C., where in March she suffered a slight injury to her left lower leg. Although she was treated by an excellent surgeon, the wound would not heal. She was then treated by a dermatologist and the ulcer progressed. In September, she was brought to Philadelphia by her sister and put under direct supervision and treatment of one of Philadelphia's ablest dermatologists. Her Wassermann test was negative. By December, the dermatologist was discouraged and told me that the ulcer was progressing in spite of everything he could do and asked for suggestions. I immediately suggested hospitalization and treatment with Tyrothricin. Reservation for admission on December 19, 1943, was made, but on December 17, 1943, she suffered a left-sided hemiplegia and was admitted on December 17, 1943, to the Delaware County Hospital. Since the onset in March she had been treated with various antiseptics, ointments, powders, hot wet compresses, ultraviolet light, *x*-rays, injections in her veins and rest in bed. At the time of admission the ulcer was 2 inches in diameter with three or four other small beginning ulcers. Treatment with Tyrothricin as in Case 1 was started on December 19, 1943. Her paralysis showed gradual improvement. After two weeks there was a marked improvement in the pain in the leg, the discharge was much less and the ulcer looked healthy. On January 23, 1944, she was discharged from the hospital with the small ulcers healed and the large ulcer about one-third its original size. Treatment with Tyrothricin was continued at home and on February 7, 1944, the ulcers were entirely healed. She has since returned to her home in Washington, D. C. and on April 1, 1944, the ulcers were still healed and there was no pain in the leg. Her paralysis has improved until she is able to walk.

CONCLUSIONS

1. Six cases of old chronic ulcers are reported in which the patients were treated with Tyrothricin* with excellent results in five instances and no improvement in one.

2. Tyrothricin did not cause any toxic symptoms in the six patients.

3. Tyrothricin was a good anti-bactericidal agent when applied locally.

4. Tyrothricin caused no pain or discomfort when used locally in the proportion of 0.25 cc. to 99.75 cc. of water.

5. In five of the six cases Tyrothricin showed evidences of marked tissue stimulating properties.

6. I am aware of the pitfalls of a small series, but the results were so good, I believe the information should be published so others could benefit from it, while waiting for the accumulation of a large series.

REFERENCES

Rammelkamp, C. H. Use of tyrothricin in the treatment of infections. *War Med.*, 2: 830, 1942.

Hotchkiss, R. D., and Dubos, R. J. The isolation of bactericidal substances from cultures of Bacillus brevis. *J. Biol. Chem.*, 141: 155, 1941.

*The Tyrothricin was furnished through the courtesy of Parke Davis & Co.

SULFONAMIDES IN APPENDICITIS

A REVIEW OF 412 CONSECUTIVE CASES AND AN ANALYSIS OF FATALITIES

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ACUTE appendicitis imposes upon the surgical service direct responsibility for periodic review of cases and their handling in view of its high mortality and the incidence of serious complications. The present review was undertaken for a study of our results following the introduction of sulfonamides administered by the usual routes, including intraperitoneal instillation. The evidence becomes more convincing when placed against the background of previous experiences.

TABLE 1

No. of Cases:	
Flower and Fifth Avenue Hospital	163
Metropolitan Hospital	249
Total	412
Fatalities:	
Flower and Fifth Avenue Hospital	0
Metropolitan Hospital	10
Total	10
Gross Mortality:	
Flower and Fifth Avenue Hospital	0%
Metropolitan Hospital	4%
Total	2.4%
No. Receiving Sulfonamides:	
Flower and Fifth Avenue Hospital	34
Metropolitan Hospital	65
Total	99

A study of 103 cases of ruptured appendicitis was completed in 1936 at the Metropolitan Hospital. There were twenty-three deaths in this series, establishing a mortality of 22.3 per cent. It is interesting to note that in this series fifty-four patients were operated upon by the right rectus incision, the mortality rate being 27.6 per cent; while in forty cases with the McBurney incision, the mortality rate was 16.6 per cent. In this series were included ten cases in which appendicocecostomy was performed and the encouraging results obtained in overcoming distention, chemical imbalance, and the control of infection were further studied by McCabe.[1] The gross mortality for all cases of appendicitis admitted to the Flower and Fifth Avenue Hospitals and the Metropolitan Hospital prior to the introduction of sulfonamides was 5.5 per cent.

From June, 1940 to December, 1941, our series comprises 412 consecutive and unselected cases* in which appendectomy was performed. (Table 1.) The gross mortality was 2.4 per cent. Irrespective of the cause of death, all fatalities were considered as belonging to the mortality group of appendicitis. Particularly, in the Metropolitan group are found many patients seriously handicapped by organic disease and malnutrition, typical of the class of patients received in public institutions.

Ochsner[2] stated that in the United States one person died from appendicitis every twenty-nine minutes. The United States Census,[3] reporting the most frequent surgical causes of death placed appendicitis (16 per cent) second only to cancer of the stomach (27.2 per cent). Schullinger,[4] reporting 2,653 cases from the Presbyterian Hospital, placed the mortality rate at 5.8 per cent. In large series, the mortality has varied greatly,[5] Thompson reporting not a single death in 204 cases, Horsley 0.95 per cent, Barrow and Ochsner 5.3 per cent, and in the patients with generalized peritonitis the mortality as reported by Horsley was

* All members of our staff individually and as a group shared in the care of this series of cases, but special credit is due for their aid in the preparation of this report to Dr. John Herrlin, Jr., Dr. Edward J. McCabe, and Dr. Charles Halberstam.

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2.2 per cent, Reid 17.2 per cent, and Barrow and Ochsner 27.3 per cent.

When analyzing the mortality, many factors of importance must be considered. First, among these, is the type of appendicitis. In our studies, we have used the following classification (Table II): (1) Simple acute appendicitis; (2) acute purulent appendicitis with local peritonitis or abscess, and (3) ruptured appendicitis with generalized peritonitis.

TABLE II
SULFANILAMIDE SERIES

	Flower-Fifth Ave. Hospital	Metropolitan	Total
Group I			
Simple acute appendicitis	5	2	7
Group II			
Acute purulent appendicitis with local peritonitis or abscess	15	38	53
Group III			
Ruptured appendicitis with generalized peritonitis	14	25	39
Total	34	65	99

Another factor which definitely influences the mortality is the time of operation. For instance, Bower[6] established that the mortality rate of cases admitted forty-eight to seventy-two hours after onset is three times that of those admitted within twenty-four hours and jumps to four times the rate after seventy-two hours. A third factor is age with the higher mortality rates in the very young and very old. Additional points to be considered are type of incision, whether appendectomy with or without drainage or drainage alone is performed, type of anesthesia, and associated complications of which pulmonary and cardiovascular are extremely important.

Intraperitoneal sulfonamides were first used at our hospitals in June, 1940. Our first experience was confined to the intraperitoneal introduction of 50 to 100 cc. of 5 per cent neoprontosil. Due to the rapidity of absorption and secretion, this method was soon abandoned in favor of intraperitoneal sulfanilamide or sulfathiazole powder, supplemented when necessary by oral administration of the drug or hypodermoclysis of 0.8 per cent sulfanilamide or 0.5 per cent sulfathiazole. The oral or subcutaneous administration by clysis maintains a more constant blood level and is, therefore, more useful than the intravenous route.

TABLE III
ORAL AND PARENTERAL SULFONAMIDE

Group I	Flower-Fifth Ave. Hospital	Metropolitan
Age	1 to 5 yr., 1 20 to 30 yr., 3 50 to 60 yr., 1	10 to 20 yr., 1 20 to 30 yr., 1
	No. cases, 5	No. cases, 2

Total No. of cases 7
Deaths 0
Mortality 0

	Flower-Fifth Ave. Hospital	Metropolitan
Duration prior to operation (average)	61 hr.	24 hr.
Appendectomy	5	2
Appendectomy and drainage	0	0
Complications		
Wound infection	2	Bronchopneumonia, 2
Eosinophilia (undetermined etiology)	1	
Postoperative days	14	11

The local use of sulfanilamide permits a concentration localized at the site of infection that has been found to be seventy-five to one hundred times higher than the blood concentration with a consequent increase in bacteriostatic effects.[7] The blood level reaches its peak in from six to twelve hours. Sulfathiazole

powder is absorbed more slowly. As a general rule, we have employed about 12 Gm. of sulfanilamide or sulfathiazole, occasionally larger amounts, approximately three-quarters of the total amount in the peritoneal cavity, the balance sprinkled in the wound. The largest single dose we have employed in appendicitis was 18 Gm.; although, we did use 24 Gm. intraperitoneally in a patient with a rupture of the colon secondary to malignancy. Both of these patients recovered without complications that in anyway might be attributable to the sulfonamides. In children, we employ one-half or less of the adult dose. Direct local application provides immediate control of infection and limits spread by local bacteriostatic or even bactericidal action of the sulfonamide. It makes possible a rapid high blood concentration of the compound, thus increasing the constitutional coefficient. We believe that local use often requires supplemental oral or parenteral administration.

Table IV
ORAL AND PARENTERAL SULFONAMIDE

Group II	Flower-Fifth Ave. Hospital	Metropolitan
Age	10 to 20 yr., 4 20 to 30 yr., 1 40 to 50 yr., 1	10 to 20 yr., 8 20 to 30 yr., 6 30 to 40 yr., 4 40 to 50 yr., 4 60 to 70 yr., 1
	No. cases, 6	No. cases, 23

Total No. of cases..... 29
Deaths..... 1
Mortality..... 3.4%

	Flower-Fifth Ave. Hospital	Metropolitan
Duration prior to operation (average)	29 hr.	46 hr.
Appendectomy	5	23
Appendectomy and drainage	1	0
Complications		
Wound infection	1	Wound infection, 8 Pelvic abscess, 1
Pneumonia	1	Ileus, 4 Cecal fistula, 1 Pneumonia, 2 P.O. atelectasis, 2 Pulmonary embolus, 1 Cystitis, 1
Postoperative days	10	18

Table V
ORAL AND PARENTERAL SULFONAMIDE

Group III	Flower-Fifth Ave. Hospital	Metropolitan
Age	5 to 10 yr., 1 10 to 20 yr., 3 40 to 50 yr., 1	5 to 10 yr., 1 10 to 20 yr., 1 20 to 30 yr., 3 30 to 40 yr., 1 40 to 50 yr., 3 50 to 60 yr., 3
	No. cases, 5	No. cases, 12

Total No. of cases..... 17
Deaths..... 4
Mortality..... 23.5%

	Flower-Fifth Ave. Hospital	Metropolitan
Duration prior to operation	29 hr.	45 hr.
Appendectomy	2	6, 1 death
Appendectomy and drainage	3	6, 3 deaths
Complications		
Wound infections	2	Wound infections, 5
Pelvic abscess	2	Ileus, 3 Cecal fistula, 1 Pneumonia, 2 P.O. atelectasis, 1 Delirium, 1 Leucopenia and possible subhepatic abscess, 1
Postoperative days.	20	15

Sulfonamides were given by the oral route alone to a total of seven patients belonging to Group I, the simple acute appendicitis. (Table III.) As might be expected, there were no deaths. In Group II, acute purulent appendicitis with local peritonitis or abscess, sulfonamides were given to a total of twenty-nine patients

by oral and parenteral routes. (Table IV.) The single death occurred on the fifth postoperative day, in a twenty-nine-year old female (S. W., Record No. 719) with extreme obesity and necropsy demonstrated pulmonary embolism, atelectasis and postoperative ileus. Appendectomy without drainage had been performed. In Group III, ruptured appendicitis with generalized peritonitis, sulfonamides were given to seventeen patients both orally and parenterally and, of these, four died, a mortality of 23.3 per cent. (Table V.)

CASE REPORTS

CASE I. F. M., (No. 668), a forty-four-year old male, was admitted July 18, 1940, and expired July 28th. The patient was under treatment for a duodenal ulcer and was admitted to the medical service of the hospital for exacerbation of these symptoms. Thirty-six hours after admission, he was seen in surgical consultation at which time a diagnosis was made of a perforated duodenal ulcer. Roentgenograms were not taken for the presence of pneumoperitoneum, neither was diagnostic peritoneal aspiration undertaken. At operation, through a right rectus incision, no evidence of peptic ulcer was found. The appendix was found ruptured with the presence of diffuse peritonitis. Appendectomy without drainage was done. Colon bacillus was recovered on culture. Postoperatively, the patient was given sulfanilamide by the oral route. Intestinal intubation with the Miller-Abbott tube was successful, completely controlling distention and ileus. The patient also received whole blood transfusions. Wound infection was followed shortly by disruption and was treated by packing and strapping. Bronchopneumonia and epididymitis also developed. The patient succumbed on the ninth postoperative day. Postmortem examination revealed toxic myocarditis, bronchopneumonia, infarction of the right lung, toxic hepatitis, toxic hyperplastic spleenitis, peritonitis, and mesenteric abscess.

CASE II. V. B., (No. 715), a forty-year old male, was admitted May 17, 1934, and expired August 17, 1940. This patient was under treatment for tuberculosis. On August 11, 1940, the patient complained of abdominal symptoms which were attributed to a tuberculous ileocolitis. He was seen in surgical consultation on August 16th at which time a diagnosis of ruptured appendicitis and generalized peritonitis was made. Operation confirmed the diagnosis and appendectomy with drainage was performed. Following the operation, the patient was treated with neoprontosil intravenously and intramuscularly, Wangensteen intestinal decompression, and whole blood transfusion. Extreme sepsis continued with a temperature rise to 107°F. The patient expired twenty-four hours postoperatively, and postmortem examination was refused.

CASE III. M. S., (No. 774), a fifty-nine-year old female was admitted September 4, 1940, and expired September 13th. Operation was performed through a right rectus incision, and a ruptured appendicitis with generalized peritonitis found. Appendectomy with drainage was done. Bacillus coli was cultured from the peritoneal cavity. During the postoperative period, the patient was given neoprontosil intravenously and sulfanilamide orally. Wangensteen decompression of the intestine was instituted and the patient given whole blood transfusions. Cardiac decompensation and auricular fibrillation was present. Peritonitis and ileus continued, and the patient developed a pneumonia of the left lower lobe. Wound disruption further complicated the course and was treated by packing and adhesive strapping. Death occurred on the ninth postoperative day. Autopsy revealed a fulminating peritonitis with ileus and pneumonia.

CASE IV. C. O., (No. 874), a fifty-nine-year old male, was admitted October 15, 1940, and expired October 22nd. The history was of seven days' duration and the physical findings those of diffuse peritonitis. At operation, there was ruptured appendicitis with generalized peritonitis with but little attempt at localization. Appendectomy and drainage was performed. Bacillus coli and Staphylococcus aureus were cultured from the peritoneal cavity. Postoperatively, the patient received neoprontosil intravenously as well as sulfanilamide orally. The Miller-Abbott tube was passed and suction instituted by means of the Wangensteen system. In addition, the patient received four whole blood transfusions, totaling 1,500 cc. Postoperative ileus developed. In spite of generous transfusions, secondary anemia and leukopenia developed, which may be attributed to the overwhelming sepsis,

although they may have resulted from the sulfonamides. The patient expired on the seventh postoperative day and autopsy was denied.

In Group I, no patient was treated with intraperitoneal sulfonamides. In Group II, acute purulent appendicitis with local peritonitis or abscess, there was a total of twenty-four patients who received sulfonamides intraperitoneally supplemented by oral and parenteral administration when necessary with but one death, a mortality of 4.1 per cent. (Table VI.)

TABLE VI
INTRAPERITONEAL AND PARENTERAL SULFONAMIDE

Group II	Flower-Fifth Ave. Hospital	Metropolitan
Age	10 to 20 yr., 1 20 to 30 yr., 3 40 to 50 yr., 4 60 to 70 yr., 1	1 to 5 yr., 2 10 to 20 yr., 3 20 to 30 yr., 5 30 to 40 yr., 2 50 to 60 yr., 2 60 to 70 yr., 1
	No. cases, 9	No. cases, 15

Total number of cases	24
Deaths	1
Mortality	4.1%

	Flower-Fifth Ave. Hospital	Metropolitan
Duration prior to operation	25 hr.	35 hr.
Appendectomy	9	15
Appendectomy and drainage	0	0
All received intraperitoneal sulfonamide. Complications		
Wound infection	1	Wound infection, 2
Pelvic abscess	1	Pneumonia, 1
Pneumonia	1	Cardiac decompensation, 1 Toxic hepatitis, 1
Postoperative days.	14	12

The single death, M. C., (No. 563), a sixty-three-year old female, was admitted June 8, 1941 and expired June 21st. Appendectomy was performed and 50 cc. of 5 per cent neoprontosil instilled intraperitoneally. The abdomen was closed in layers without drainage. During the postoperative phase, the patient received hypodermoclysis of 0.8 per cent sulfanilamide solution, transfusions of whole blood, and supportive therapy for cardiac decompensation and auricular fibrillation. Peripheral circulatory collapse developed which was believed to be secondary to cardiac decompensation and generalized peritonitis. The patient expired on the third postoperative day, and at autopsy toxic myocarditis was found with generalized peritonitis and pericecal abscess.

TABLE VII
INTRAPERITONEAL SULFONAMIDE

Group III	Flower-Fifth Ave. Hospital	Metropolitan
Age	5 to 10 yr., 2 10 to 20 yr., 2 30 to 40 yr., 3 40 to 50 yr., 1 50 to 60 yr., 1	5 to 10 yr., 3 10 to 20 yr., 1 20 to 30 yr., 2 40 to 50 yr., 2 50 to 60 yr., 3 60 to 70 yr., 1 70 to 80 yr., 1
	No. cases, 9	No. cases, 13

Total No. of cases	22
Deaths	3
Mortality	13.5%

	Flower-Fifth Ave. Hospital	Metropolitan
Duration prior to operation	56 hr.	52 hr.
Appendectomy	7	9, 2 Deaths
Appendectomy and drainage	2	4, 1 death
Complications		
Wound infections	1	Wound infections, 7
Hypoprotenemia	1	Pelvic abscess and ileus, 1 Intestinal obstruction, 1 Cecal fistula, 1 Pneumonia, 1 Thrombocytopenia purpura and hyperleucocytosis, 1
Postoperative days.	14	19

Intraperitoneal sulfonamides, supplemented by oral and parenteral administra-

tion when deemed advisable, were given to twenty-two patients in Group III (ruptured appendicitis with generalized peritonitis). In this last group, there were three deaths, a mortality of 13.5 per cent. (Table VII.)

Case I. H. B., (No. 142), a fifty-four-year old male, was admitted January 27, 1941, and expired February 2nd. The patient had active pulmonary tuberculosis with bilateral lesions. There was a 70 per cent collapse of the left lung. Symptoms were present for forty-eight hours prior to admission, and the abdominal signs at time of admission suggested ruptured appendicitis with generalized peritonitis, which was confirmed at operation. Appendectomy without drainage was performed and 50 cc of 5 per cent neoprontosil instilled into the peritoneal cavity. Postoperatively, the patient was given 5 per cent neoprontosil by the intravenous route and sulfathiazole by mouth. Intestinal intubation with the Miller-Abbott tube and Wangensteen suction controlled distention and ileus. Three transfusions of whole blood were given. A wound infection with disruption and a cecal fistula occurred. The patient expired on the sixth postoperative day. Necropsy confirmed previous findings of active bilateral pulmonary tuberculosis with artificial pneumothorax and collapse of the left lung, generalized peritonitis and a cecal fistula.

Case II. J. M. (No. 374), an eight-year old male child, was admitted on February 26, 1941, and expired on March 31st, the thirty-second postappendectomy day. Abdominal symptoms were present for seven days prior to admission to the hospital. At operation, ruptured appendicitis with generalized peritonitis were present. Appendectomy and appendicocecostomy were done. Bacillus coli was cultured from the peritoneal cavity. Five per cent neoprontosil, 50 cc. was instilled intraperitoneally. Postoperatively, sulfanilamide was administered orally for nearly three weeks. Eight transfusions of 250 cc. of whole blood was given. The Miller-Abbott tube was passed into the small intestine. Drainage from the Miller-Abbott tube and the appendicocecostomy was good but did not completely relieve the abdominal distention. The child was kept in an oxygen tent. Severe infection developed in the appendicocecostomy wound and a high temperature persisted. It was believed that further intraperitoneal suppuration was present, although no definite diagnosis of subhepatic or pelvis abscess could be made. There was definite evidence pointing to multiple points of partial intestinal obstruction. A laparotomy was performed on March 31st at which time multiple small intraperitoneal abscesses and numerous adhesions were found. The patient expired shortly after the second laparotomy in spite of careful supportive treatment. Autopsy did not reveal additional data.

Case III. F. K., (No. 123850), a thirty-two-year old male, was admitted on August 6, 1941, and discharged on November 18th. Appendectomy was performed and 12 Gm. of sulfanilamide introduced into the peritoneal cavity. The abdomen was closed without drainage. Twelve hours later, the blood level was total 10.4, free 8.8, conjugated 1.6. Hypodermoclyses of 1,000 cc. of 0.8 per cent sulfanilamide solution was given daily for three days. The blood level on August 7th was total 16.15, free 15.0, conjugated 1.15; on August 8th, total 7.25, free 6.6, conjugated 0.65; on August 9th, total 8.8, free 7.7, conjugated 1.1; August 11th, total 3, free 1.7, conjugated 1.3. The clinical picture indicated the need of further sulfonamide therapy, and on August 11th, 100 cc. of 5 per cent sodium sulfathiazole was given intravenously. Cyanosis and relative anuria, 400 to 500 cc. persisted for the first two postoperative days. The Miller-Abbott tube and Wangensteen suction were utilized for the relief of distention and ileus, and in addition the patient was given two whole blood transfusions. Jaundice was first noted on August 31st and rapidly progressed, the Van den Bergh reaction becoming positive direct and the icteric index reaching a high of 100 on August 15th. The total plasma protein 5.22, albumin 2.5, globulin 2.5, fibrinogen 0.22, vitamin C 0.61. The icteric index fell to 25 on August 20th and 12 on September 2nd. The patient was discharged and returned for follow-up on November 17th at which time the icteric index was 14.8 and the Van den Bergh positive delayed.

This patient is the only one under our observation who exhibited a toxic hepatitis with jaundice, although others have observed it rather frequently.[16,19,20,21]

Case IV. M. M., (No. 909), a four-year old female child, was admitted on October 16, 1941, and expired on October 19th. At operation, a ruptured appendicitis and diffuse peritonitis was found. Appendectomy was done, 4 Gm. of sulfathiazole powder placed intraperitoneally and the abdomen closed without drainage. Sulfathiazole, Gm. ½, was given every four hours, beginning twenty-four hours postoperatively and continuing until October 19th. A total of 3½ Gm. was given by the oral route. The sulfathiazole blood level on October 18th was: Total 3.60, free 3.00, conjugated 0.60. The patient was apparently having an uneventful convalescence until October 18th when blood was noted in one bowel movement. The remainder of the day passed without further incidence, and the following morning the child appeared in good condition. At 2:30 P.M., the patient had a chill which was followed very shortly by foaming at the mouth and a very definite convulsion. At examination, temperature was 98.4°F., heart rate 200. The skin was cool. Small, purplish ulcers were present on the buccal mucosa and tongue. A right facial paresis developed, the eyes deviated to the right, and the pupils became dilated and fixed. The abdomen rapidly became distended. Bloody stool and urine were present. The temperature rose to 103°F. At 5:30 P.M., convulsions developed again, involving the left arm and leg. Convulsions continued again until 7 P.M. Respiration of the Cheyne-Stokes type developed, heart sounds became barely audible, and the patient expired at 7:30 P.M.

The laboratory data are of particular interest. Prior to operation on October 16th, the hemoglobin was 90 per cent, the leucocytes 20,000, the polymorphonuclear leucocytes 75, the lymphocytes 25. The urine was light yellow in color, acid reaction, no albumin or sugar was present, acetone was present, there were no abnormal microscopic findings. On October 19th, hemoglobin was 86 per cent, erythrocytes 3,750,000; leucocytes 80,000; thrombocytes 39,000. The leucocyte differential: mature polymorphonuclear 33; band polymorphonuclear 10; metamyelocytes 10, myelocytes 20; myeloblasts 2; lymphocytes 17; monocytes 2; Turk's irritation cells 2; eosinophiles 2, basophiles 2. The smear also showed marked toxic granulations present in the leucocyte series and 6 nucleated erythrocytes for every 100 leucocytes. Necropsy was denied.

However, there is fairly conclusive evidence that the child expired as a result of thrombosytopenic purpura secondary to sulfathiazole therapy. Thrombocytopenic purpura has been reported to follow sulfathiazole[10,11] therapy as well as sulfanilamide,[12,13] sulfapyridine[14] and sulfadiazine.[15] Hyperleucocytosis has not previously been noted to follow sulfathiazole therapy. This is the only fatal complication which we have observed that could be attributed to sulfonamide therapy. The dosage administered in this case does not appear to have been excessive. The largest single dose we have administered in appendicitis was 18 Gm. of sulfathiazole intraperitoneally and no reaction was observed. In a male child of seven years with a ruptured appendicitis and generalized peritonitis 15 Gm. of sulfathiazole powder was placed within the peritoneal cavity. The following day, the blood level was total 2.04, free 1.82, and conjugated 0.22. Oral administration was begun giving ½ Gm. every four hours for twenty-four hours. The blood level at this time was total 23.68, free 21.62, and conjugated 2.06. Administration of the drug was immediately discontinued, and the uneventful postoperative convalescence continued.

As have others, we have observed mild toxic symptoms following sulfonamide therapy which do not require cessation of the drug or rapidly regress when administration of the drug is discontinued.[16] Cyanosis has frequently been noted with sulfanilamide therapy, and nausea and vomiting have not uncommonly followed sulfanilamide and sulfathiazole therapy. (Fever has occasionally returned rapidly to normal when the drug is discontinued.) Skin rash,[17] frequently resembling that of measles, will follow sulfathiazole, and even acute exfoliative dermatitis has been reported.[18] Cyanosis and delirium were present in two patients following the

use of sulfanilamide. Both patients had stormy convalescences. Relative anuria and hepatitis with jaundice has been observed.

Mild urinary complications, namely, crystalluria, occasionally hematuria and rarely relative anuria has been observed. Interruption of the drug therapy and forcing fluids has rapidly corrected the difficulty. Many severe urinary complications have been reported to follow sulfapyridine,[22,23] sulfathiazole or sulfadiazine therapy.[24–32]

TABLE VIII
COMPLICATIONS

	Parenteral Sulfonamides		Combined Sulfonamides	
	F.F.A.H., Per Cent	Metropolitan, Per Cent	F.F.A.H., Per Cent	Metropolitan, Per Cent
Wound	35.7	35.1	15	32.1
Pulmonary	7.1	26.7	5	7.1
Miscellaneous	21.4	29.7	10	17.8

Sulfonamides, in a relatively small percentage of cases, incite toxic manifestations of the hemopoietic system. Leucopenia has infrequently been observed. The serious reaction, acute agranulocytosis is not unknown,[33,34,35] but, unfortunately, has not complicated our cases. We have observed mild forms of anemia but no severe hemolytic anemia has developed in our series that might be ascribed to the use of sulfonamides. Aplastic anemia has followed the use of sulfathiazole.[36]

There is apparently little danger of the formation of adhesions from the intraperitoneal application of sulfanilamide powder. However, sulfathiazole powder may be a contributing factor according to several observers.[19,37,38] We have not observed this danger following intraperitoneal implantation, but it has been our clinical impression that sulfathiazole powder has occasionally delayed wound healing. Interference with wound healing has not been noted to follow sulfanilamide.

Recently, it has been emphasized that there may exist an acquired sensitivity to the sulfonamides.[39–43] A patient who has received a previous course with sulfanilamide or one of its derivatives may react adversely to extremely small doses. It behooves the clinician to inquire as to previous administration and, particularly, whether any drug reaction occurred.

We have had no cases exhibiting focal necrotic lesions recently described and attributed to sulfathiazole.[44,45]

The oral and parenteral administration of sulfanilamide was rapidly supplanted by the intraperitoneal application for the more advanced forms of appendicitis.[5,7,8,47,48,49,50,51] Prior to the local use for appendicitis sulfanilamide had been used locally in dental surgery[52] and compound fractures.[53] It was also used intraperitoneally for pneumococcal peritonitis, perforating abdominal wounds,[55] and is now used prophylactically following gastric and intestinal resection and anastomoses.[56,57] There is laboratory and clinical evidence accumulating that the oral and parenteral or intraperitoneal administration of sulfathiazole or its soluble sodium salt is effective in treating peritonitis.[58–63] Its rate of absorption from the peritoneal cavity is slower than sulfanilamide and may, therefore, exert its local action over a longer period. In a number of instances, we have combined the use of 8 Gm. of sulfanilamide and 4 Gm. of sulfathiazole, mixing the powder well, and placing it intraperitoneally at the site of appendectomy. This may prove to be very advantageous, particularly since two or more organisms are frequently cultured from the peritoneal cavity and sulfanilamide is relatively ineffective against the staphylococcus. The use of microcrystals of sulfathiazole[64] may overcome the objections of some that it has a tendency to "cake" and form adhesions. There are relatively few observations on the merits of intraperitoneal sulfapyridine.[65]

With the intraperitoneal administration, the incidence of complications was lower than when only oral and parenteral routes were utilized. (Table VIII.) Similarly, the mortality rate was lower when the sulfonamides were employed intraperitoneally.

Another important consideration in the management of Groups II and III is the question of drainage. In sixteen cases in which drainage was employed, there were four deaths, a mortality rate of 25 per cent; but in eighty-three patients not drained, there were five deaths, a mortality rate of 6 per cent. Drainage is indicated when localized abscess is present, but it adds to the hazard when there is generalized peritonitis. Again in favor of intraperitoneal sulfonamides is a shorter number of hospital days.

It is obvious that many factors have contributed an important share to the reduction of our mortality. Among these is the judicious use of intravenous chlorides, plasma or blood to establish an optimum fluid balance during the pre- and postoperative period. Fluid balance should be established before as well as after operation. The routine use of the McBurney incision has contributed to the lowered mortality rate as has been emphasized by many observers. A better understanding of the rôle of oxygen[66] and improved anesthesia technic share in the credit. Lastly, a more widespread understanding on the part of our staff in the fundamental importance of prompt and continuous intestinal decompression by the Wangensteen[67] or Furness[68] suction as well as efficient use of the Miller-Abbott tube are vital factors in the management of acute appendicitis except for the addition of the sulfonamides. Since then, the mortality rate has steadily been reduced so that since this study was completed a further group of over 200 consecutive patients of all types have been operated upon without a death. There is definite evidence of the great value of the local and general use of the sulfonamides in the reduction of the serious complications and of mortality of in the severe forms of acute appendicitis.

REFERENCES

1. McCabe, E. J. Appendicocecostomy in acute ruptured appendicitis with peritonitis. Presented before Graduate Fortnight at Flower-Fifth Avenue Hospital, October, 1940.
2. Ochsner, A. The technique of appendectomy. *Surgery*, 2: 532–552, 1937.
3. United States Census. Quoted in Ochsner, A.[2]
4. Schullinger, R. N. Acute appendicitis and associated lesions: some observations on mortality. *Arch. Surg.*, 32: 65–98, 1936.
5. Thompson, J. E., Brabson, J. A. and Walker, J. M. Intra-abdominal application of sulfanilamide in acute appendicitis. *Surg., Gynec. & Obst.*, 72: 722–727, 1941.
6. Bower, J. O. a, Spreading peritonitis complicating appendicitis. *Surg., Gynec. & Obst.*, 54: 835–846, 1932. b, Acute appendicitis in Philadelphia: report of progress made in campaign for its reduction. *J. A. M. A.*, 102: 813, 1937. c, Bower, J. O., Burns, J. C. and Mengle, H. A. Induced spreading peritonitis complicating acute perforative appendicitis. *Surg., Gynec. & Obst.*, 66: 947, 1938.
7. Mueller, R. S. and Thompson, J. E. Local use of sulfanilamide in the treatment of peritoneal infections. *J. A. M. A.*, 118: 189–193, 1942.
8. Mueller, R. S. Use of powdered crystalline sulfanilamide in surgery. *J. A. M. A.*, 116: 329, 1941.
9. Tashiro, K., Pratt, O. B., Kabayaski, N. and Kawaicki, G. K. Local implantation of sulfanilamide in peritoneal cavity and its clinical application in peritonitis. *Surgery*, 11: 671–689, 1942.
10. Werner, W. I. Thrombocytopenic purpura following administration of sulfathiazole. *Southwest. Med.*, 26: 49–50, 1942.
11. Rosenfeld, F. and Feldman, F. Sulfathiazole causing thrombocytopenic purpura. *J. A. M. A.*, 118: 974–975, 1942.
12. Hageman, P. O. and Blake, F. G. Clinical experience with sulfanilamide in the treatment of beta hemolytic infections. *Am. J. M. Sc.*, 195: 163, 1938.
13. Spink, W. W. Sulfanilamide and Related Compounds. 2nd ed., p. 306. Chicago, 1942. The Year Book Publishers, Inc.
14. Russel, H. K. and Page, R. C. Thrombocytopenic purpura due to sulfapyridine. *Am. J. M. Sc.*, 200: 495, 1940.
15. Whitehouse, F. R. and Watkins, C. H. Acute thrombocytopenic purpura following sulfadiazine therapy: report of case. *Proc. Staff Meet., Mayo Clin.*, 17: 140–143, 1942.
16. Long, P. H., Haviland, J. W., Edwards, L. B. and Bliss, E. A. Toxic manifestations of sulfanilamide and its derivatives with reference to their importance in the course of therapy. *J. A. M. A.*, 115: 364, 1940.
17. Haviland, J. W. and Long, P. H. Skin conjunctival and scleral reactions in the course of therapy

with sulfathiazole. *Bull. Johns Hopkins Hosp.*, 66: 313, 1940.
18. Weinstein, M. and Domm, A. H. Development of acute exfoliative dermatitis during administration of sulfathiazole. *J. A. M. A.*, 117: 607, 1941.
19. Jackson, H. C. and Collier, F. A. The use of sulfanilamide in the peritoneum. *J. A. M. A.*, 108: 194–199, 1942.
20. Lesser, M. F. and Starr, A. Toxic effects from intraperitoneal use of sulfanilamide. *New England J. Med.*, 226: 558–561, 1942.
21. Berger, S. S. and Applebaum, H. S. Toxic hepatitis due to sulfanilamide: report of fatal case with histopathologic findings in the liver. *J. Lab. & Clin. Med.*, 26: 785–792, 1941.
22. Dourmaskin, R. L. and Worton, M. Anuria due to complete bilateral ureteral impaction with concretions following the use of sulfapyridine in pneumonia. *New York State J. Med.*, 41: 146, 1941.
23. Newman, H. R. and Schlesser, I. H. Sulfonamide renal calculus surgically removed two years after administration of sulfapyridine. *J. Urol.*, 47: 258, 1942.
24. Winsor, T. and Burch, G. E. Renal complications following sulfathiazole therapy. *J. A. M. A.*, 118: 1346–1353, 1942.
25. Kawaicki, G. K. and Rogers, W. B. Urinary calculi from sulfonamides. *Urol. & Cutan. Rev.*, 45: 477, 1941.
26. Lundner, H. J. and Atcheson, D. Sulfathiazole crystallization in the kidney. *J. Urol.*, 47: 262–266, 1942.
27. Garvin, C. F. Renal complications due to sulfathiazole. *J. A. M. A.*, 116: 300, 1941.
28. Arnett, J. H. Hematuria from sulfathiazole therapy in pneumonia. *J. A. M. A.*, 115: 362, 1940.
29. Keitzer, W. A. and Campbell, J. A. Renal complications of sulfadiazine. *J. A. M. A.*, 119: 701–703, 1942.
30. Bradford, H. A. and Shaffer, J. H. Renal changes in a case of sulfadiazine anuria. *J. A. M. A.*, 119: 316–318, 1942.
31. Hellwig, C. A. and Reed, H. L. Fatal anuria following sulfadiazine therapy. *J. A. M. A.*, 119: 561–563, 1942.
32. Hughes, B., Sayen, J. L., LaTowsky, L. W. Sulfadiazine calculi in the urinary tract. *J. Urol.*, 47: 274–276, 1942.
33. Kennedy, P. C. and Fundland, M. Fatal agranulocytosis from sulfathiazole. *J. A. M. A.*, 116: 295, 1941.
34. Pippin, B. I. Staphylococcemia and agranulocytosis; report of three cases, with special reference to drug toxicity. *Wisconsin M. J.*, 40: 194, 1941.
35. Curry, J. J. Acute agranulocytosis following sulfadiazine. *J. A. M. A.*, 119: 1502–1503, 1942.
36. Meyer, L. M. and Perlmutter, M. Aplastic anemia due to sulfathiazole. *J. A. M. A.*, 119: 558–559, 1942.
37. Sutton, H. B. The intraperitoneal use of sulfathiazole, with special reference to the production of adhesions. *J. A. M. A.*, 119: 559, 1942.
38. Taylor, F. W. Misuse of sulfonamide compounds (sulfanilamide and sulfanilamide derivatives). *J. A. M. A.*, 118: 959–961, 1942.
39. Davidson, A. and Bullowa, J. G. M. Acquired sensitivity to sulfapyridine and sulfamethylthiazole. *New England J. Med.*, 223: 811, 1940.
40. Stiles, M. H. Hypersensitivity to small doses of sulfathiazole. *Pennsylvania M. J.*, 44: 823, 1941.
41. Nelson, J. Acquired sensitivity to sulfanilamide drugs. *J. A. M. A.*, 119: 560–561, 1942.
42. Wedum, A. G. Immunological specificity of sulfonamide azoproteins. *J. Infect. Dis.*, 70: 171, 1942.
43. Editorial. Sulfonamide sensitivity. *J. A. M. A.*, 119: 1202–1203, 1942.
44. Merkel, W. C. and Crawford, R. C. Pathologic lesions produced by sulfathiazole. *J. A. M. A.*, 119: 770–776, 1942.
45. Lederer, M. and Rosenblatt, P. Death during sulfathiazole therapy. Pathological and clinical observations on four cases with autopsies. *J. A. M. A.*, 119: 8–18, 1942.
46. Ravdin, I. S., Rhoads, J. E. and Lockwood, J. S. Use of sulfanilamide in treatment of peritonitis associated with appendicitis. *Ann. Surg.*, 111: 53, 1940.
47. Dees, J. G. Valuable adjunct in perforated appendices. *Mississippi Doctor*, 18: 215, 1940.
48. Rosenburg, S. and Wall, M. The treatment of diffuse peritonitis by the direct intraperitoneal introduction of sulfanilamide. *Surg., Gynec. & Obst.*, 72: 568, 1941.
49. Lee, Q. B. The use of sulfanilamide powder in abdominal surgery. *South. Surg.*, 10: 680, 1941.
50. Estrin, J. H. Intraperitoneal application of sulfanilamide in peritonitis complicating appendicitis; report of thirty cases. *Med. Rec.*, 154: 189, 1941.
51. Hadley, M. N. Sulfanilamide in appendicitis with abscess. *J. Indiana State M. A.*, 34: 543, 1941.
52. Sinclair, J. A. Preliminary report on local use of sulfanilamide in the treatment of oral lesions. *J. Canad. Dent. A.*, 3: 571, 1937.
53. Jensen, N. K., Johnsrud, L. W. and Nelson, M. C. Local implantation of sulfanilamide in compound fractures. *Surgery*, 5: 1, 1939.
54. Newell, E. T., Jr. Primary streptococcus and pneumococcus peritonitis in children; study of sixty-one with report of two interesting recoveries. *Surg., Gynec. & Obst.*, 68: 760–766, 1939.
55. Rippey, E. L. Perforating gunshot wounds of the abdomen. *J. A. M. A.*, 115: 1760, 1940.
56. Hudson, R. V., Smith, R. and Selbie, F. R. Prognosis of acute intestinal obstruction; experiments with intraperitoneal sulfanilamide. *Lancet*, 1: 438–442, 1941.
57. Varco, R. L., Hay, L. J. and Stevens, B. Value of local implantation of crystalline sulfanilamide about gastrointestinal anastomoses in dogs: valuable adjunct in prevention of peritonitis. *Surgery*, 9: 863, 1941.
58. Pearl, M. J. and Reckles, J. A. Local implantation of sulfathiazole as a therapeutic and prophylactic measure in peritonitis: experimental study. *West. J. Surg., Obst. & Gynec.*, 50: 99–103, 1942.
59. Anderson, R. K. Sulfathiazole as an adjunct to surgery in advanced acute appendicitis. *J. A. M. A.*, 118: 892, 1942.
60. Jackson, A. S. Chemotherapy an adjunct to surgery with report of use of sulfathiazole

intraperitoneally. *South. Surg.*, 11: 274–282, 1942.

61. Gottesman, J. and Goldberg, H. Acute appendicitis with generalized peritonitis treated by intravenous and direct intraperitoneal injection (sodium sulfathiazole and sulfapyridine, sulfanilamide derivatives). *J. A. M. A.*, 118: 297–298, 1942.
62. Stafford, E. S. Value of sulfathiazole (sulfanilamide derivative) in treatment of peritonitis and abscesses of appendiceal origin. *Surg., Gynec. & Obst.*, 74: 368–369, 1942.
63. Jonas, A. F. Sulfathiazole in the treatment of appendiceal peritonitis. *Am. J. Surg.*, 57: 112, 1942.
64. Chambers, L. A., Harris, T. M., Schumann, F. and Ferguson, L. K. The use of microcrystals of sulfathiazole in surgery. *J. A. M. A.*, 119: 324–327, 1942.
65. Gardener, R. H. Intraperitoneal sulfapyridine in acute abdominal conditions. *Lancet*, 1: 195, 1942.
66. Chase, H. C. Anoxia—its surgical significance. *Internat. Abstr. Surg.*, 73: 106, 1941.
67. Wangensteen, O. H. and Paine, J. R. Treatment of acute intestinal obstruction with the duodenal tube. *J. A. M. A.*, 101: 1532, 1933.
68. Furniss, D. H. Modified Wangensteen suction drainage. *Surg., Gynec. & Obst.*, 66: 118, 1939.
69. Abbott, W. O. and Johnston, C. G. Intubation studies of the human small intestine. X. A nonsurgical method of treating, localizing and diagnosing the nature of obstructive lesions. *Surg., Gynec. & Obst.*, 66: 691–697, 1938.
70. Leigh, O. C., Nelson, J. A. and Swenson, P. C. The Miller-Abbott tube as an adjunct to surgery of small intestinal obstructions. *Ann. Surg.*, 111: 186–212, 1940.
71. Abbott, W. O. Indications for the use of the Miller-Abbott tube. *New England J. Med.*, 225: 641–646, 1941.

The cause of cervicitis is always bacterial, the organisms concerned being the *gonococcus*, or any one of a number of other bacteria which are normal inhabitants of the genital canal or which are introduced from the outside. In this latter group the various strains of *streptococci* are most important.

GASTRIC LESIONS HIGH ON THE LESSER CURVATURE

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A GASTRIC lesion situated high on the lesser curvature is at times a difficult problem technically. An ulcer in this area makes it impossible to do a subtotal gastrectomy and at the same time remove the ulcer.

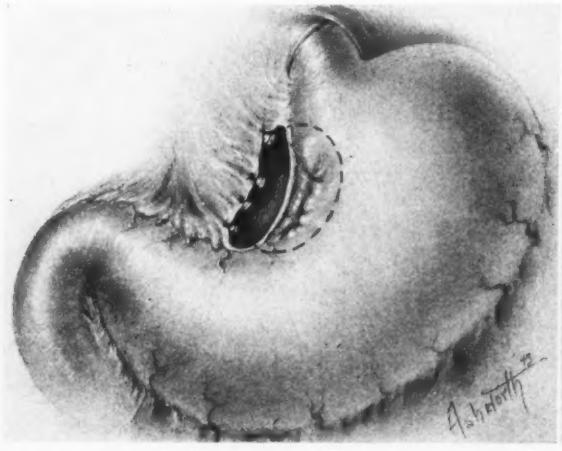

FIG. 1. Elliptical excision of the lesion instead of a v-shaped excision.

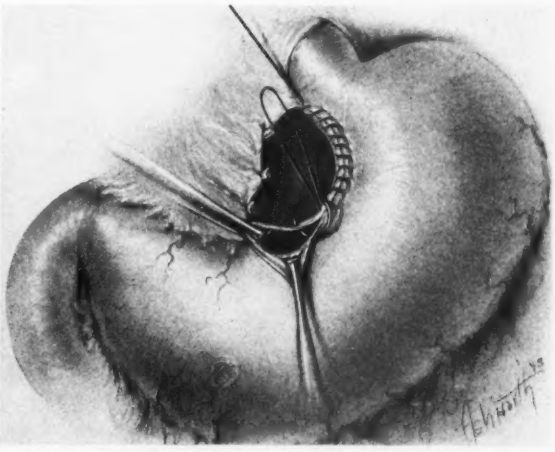

FIG. 2. Suture of anterior wall of the stomach to the posterior wall instead of suturing anterior to anterior and posterior to posterior as in a v-shaped resection.

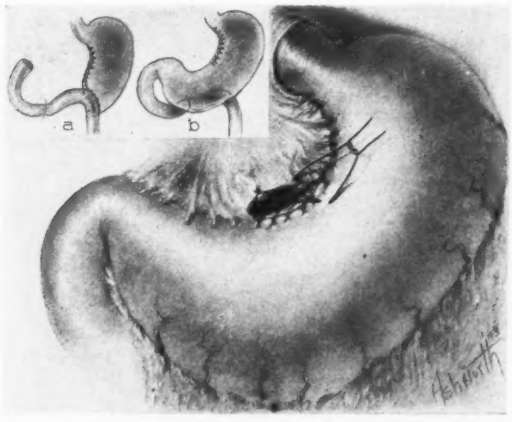

FIG. 3. Completion of suture and choice of (*a*) partial gastrectomy, or (*b*) posterior gastroenterostomy.

The v-shaped resection of such an ulcer, especially if sizeable, leads to considerable buckling and tension of the stomach, and if the ulcer is very high up has a considerable danger of leakage.

A gastric carcinoma in this area might well be subjected to a total gastrectomy, yet, in some cases due to difficult exposure, or the condition of the patient, it might be impossible to do this, or too formidable an operation. In other cases if there were a large ulcerative carcinoma of this area with liver metastasis, a total gastrectomy would be contraindicated and yet the removal of the ulcerative lesion might well prolong and make more livable the patient's life. In addition to this there are many reasons why a total gastrectomy is not a desirable operation except for lesions involving the greater part of the stomach or in cases of linitis plastica or in certain types of sarcoma. These reasons are: (1) The mortality is very high in average hands in total gastrectomy, and probably at least 15 per cent even in the most skillful hands. (2) The survival period on the average after total gastrectomy is not long. (3) Stricture at the anastomosis occurs frequently. (4) A total gastrectomy may possibly throw a patient

into pernicious anemia who had previously been in a state of balance, but whose intrinsic factor is dependent more than usual on gastric mucosa.

I propose and have carried out the following method of handling this type of case: The lesion is removed in an elliptical manner and instead of suturing the defect in the usual manner as after the ordinary v-shape incision of an ulcer, the anterior wall of the stomach is sutured to the posterior wall of the stomach. This may be done even if the lesion extends well down from the cardia. No tension results in this suture and there is no tendency to leakage. A posterior gastro-enterostomy is then done in the usual manner. The reason for doing the gastro-enterostomy is that the innervation and control of the pylorus are interfered with by the resection of the lesion. The possibility of the occurrence of a jejunal ulcer if this procedure were to be used for an ulcer with high acidity must be considered. In such a case it might be possible to combine such suture of the gastric wall high up with a subtotal gastrectomy at the ordinary level in place of the posterior gastro-enterostomy, although I have never personally done this as yet. (Figs. 1 to 3.)

SUMMARY

For a limited group of cases of ulcer or carcinoma high up on the lesser curvature of the stomach which for one reason or another may not be considered for total gastrectomy, a method of handling has been suggested and successfully practiced.

TREATMENT OF FRACTURES

APPLICATION OF THE PRINCIPLE OF REST

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FRACTURES have now achieved outstanding distinction in the general hospital. Three years ago it was estimated by one of our authorities that more than 100,000 fractures occurred annually in the United States. The automobile and high speed travel have brought this about. Statistics indicate that two-thirds of all automobile accidents occur in rural communities; and since the high speed automobile is responsible for the majority of accidents, the hospitals along the main highways receive many of these serious and complicated fractures. As a senior attending surgeon in a not very large but busy and approved hospital on the main highway midway between New York and Albany, the writer has had ample opportunity to treat personally and observe the treatment rendered many fractures. A few observations based on this experience are the inspiration of this paper.

John Hunter advocated rest as a routine measure in the treatment of disabilities of the motor system of the human body. After him came John Hilton who regarded rest as the most powerful aid which the surgeon could bring to the aid of disordered tissues. Hilton elaborated the means of securing rest into a system. Following Hilton, Hugh Owen Thomas made rest his creed and ritual in the treatment of fractures. Thomas believed that an overdose of rest was impossible. To use the expression which was oft repeated by him, rest must be "Enforced, uninterrupted, and prolonged." These three men appeared in British surgery at successive periods; Hunter 1728–1793; Hilton 1807–1878; and Hugh Owen Thomas 1834–1891. With each successive man and period rest became more urgently advocated as the best means of assisting the natural powers of repair to correct the violence done by disease or injury. Hugh Owen Thomas held that in only *one* way could the surgeon aid the repair of injured or diseased tissue and that was by giving the part rest. His message to the surgeons of his time was that they did not understand the meaning of the word rest.

What are the many factors interfering with rest in the management of a fracture? The slogan, "splint them where they lie," immediately applies the principle of rest besides preventing further displacement of fragments. For to transport a patient with a fracture of the shaft of a long bone without adequate splinting results in added vessel, muscle and nerve injury. The limb should be placed as nearly as possible in the position of muscle equilibrium and no patient suffering from a fracture of a long bone shaft should be moved until the best available fixation has been applied. Not infrequently a patient with a fractured femur is placed in the back seat of a car and in this way transported to the hospital. In a fracture of the humerus the weight of the limb, supported at the wrist with a few turns of bandage fixing the arm to the chest, is sufficient to transport the patient in the upright position. Traction in the humerus is frequently unnecessary, in fact overtraction is sometimes obtained from the weight of the forearm itself.

The unreduced fracture is another cause of unrest. Effusion of blood into the tissues and increase of tissue fluid in the region of the injury are normal reactions that make for swelling. Furthermore an irritation of the afferent nerves at the site of the fracture sets up a reflex spasm of the muscles

which is nature's attempt to obtain rest. It is much easier to reduce a fracture before the swelling and muscle spasm have occurred. Hence the principle holds that a fracture should be reduced as early as possible after the injury to secure rest. Fractures should, therefore, be treated as an emergency day or night. The terse saying of Strohmeyer regarding strangulated hernia applies equally well to fractures, "Do not let the sun rise on a fracture if first seen at night; and do not let the sun set upon a fracture if first seen by day."

Function and not the *x*-ray should be the basis for judging a fracture result. Many times we are influenced too much by the *x*-ray in the treatment of fractures. Judging the fracture solely on the *x*-ray film alone has often led to many useless manipulations and open reductions. On the other hand failure of *x*-ray to show a cabinet makers reposition of the fragments may result in suits for mal-practice despite the fact that the patient may have a perfect function. This results in frequent attempts to obtain good *x*-ray reduction with unnecessary trauma to nerves, muscles and blood supply and not infrequently non-union. In a fresh fracture the most important single factor in securing union is absolute immobilization, and it is generally conceded that one of the most frequent causes of non-union is incomplete immobilization or repeated changes in the position of the fragments while union is in progress. When immobilization is not practicable from the beginning and traction is necessary, immobilization preferably with plaster should be applied as soon as traction is no longer needed.

Other factors interfering with rest are faulty fixation and pressure. If circular casts are applied they should be bi-valved immediately since pain and pressure are forms of restlessness. Anything which surrounds or compresses a joint or bone assists in the repair in so far as it lessens the movement of the joint, but hinders it in so far as it compresses it, since it impedes the circulation of the limb.

Another form of unrest is too early and too vigorous application of physical therapy. There is at this time a wave of physiotherapy sweeping the country and in many instances this has done more harm than good because it is begun too early and too vigorously. While it is true that the muscles and joints should be exercised whenever and wherever possible, yet this should not interfere with rest. The principle of rest should be applied the moment the fracture is seen and continued until the fragments are firmly united by callus. Since union is the first consideration in the treatment of fractures, an effort to secure union in good functional position should dominate the treatment. Our efforts to obtain movement in the neighboring joints and power in the muscles of the limb should be of secondary consideration, for the first objective in the treatment of any fracture is to secure union, and only rest gives the fragments every possible chance to unite. There are many ways of treating the same fracture, each method having its advantages and disadvantages. A close statistical study of any series of fracture cases, however, will reveal that delayed union and non-union occur less often when the principle of rest "absolute, uninterrupted and enforced" can be employed from the very beginning.

Case Reports

ISOLATED FRACTURES OF THE FIRST RIB ASSOCIATED WITH BLAST FORCES

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BECAUSE of the rarity of isolated fractures of the first rib report is herein submitted of seven such fractures incurred by six sailors in an explosion at sea. These cases are also of interest because of the presumed mechanism of injury. In none does the history suggest direct injury to the rib, but all were exposed to blast force. Review of the literature on blast injuries does not reveal mention of fractures of the first rib. Hence, the value of keeping in mind the possibility of this fracture in such injuries might well be emphasized in this report. Conversely, when this fracture is found it would be appropiate to seek other possible injuries that may also have been caused by such induced force, for, as will later be described, fractures of the first rib alone are not very likely to be caused by direct injury. The two logical mechanisms are indirect pressure and muscle tension.

CASE REPORTS

CASE I. While standing in line in the galley passageway near the officers' quarters, this sailor saw a flash from these quarters. He felt himself lifted from the floor and lost consciousness. Upon revival he saw sparks and flames around him, and found that he was lying on several other men. A hot metal bar was bent across but not touching him. While sliding out from under this, he burned his hands. He has no further recollection until revival at this hospital. Injuries consisted of fracture of the left first rib at its midpoint, second degree burns involving 41 per cent of skin surface with smaller sites of third degree burns, bilaterally perforated ear drums and blast injuries of both lungs. This sailor was admitted on January 3, 1944, and was discharged on January 25, 1944, to another hospital. He was ambulatory on discharge.

CASE II. While standing in line in the galley passageway this sailor heard an explosion, saw a flash of light, and was rendered unconscious. When he revived there was much smoke about him and he was unable to stand. He crawled to the deck through the officers' mess and was carried by stretcher to the Coast Guard boat. Injuries involved fracture of the right first rib at the tubercle, bilaterally perforated ear drums, deep second degree burns, including 52 per cent of skin surface, with multiple third degree sites over the lower extremities, and laceration on the right side of the face. This man was admitted January 3, 1944, and was discharged greatly improved, to another hospital on February 1, 1944, by ambulance.

CASE III. This sailor steered the ship into the harbor, anchored, and went to sleep about three and a half hours before the explosion. He awoke in this hospital. Injuries consisted of comminuted fracture of the right first rib posterior to the tubercle, deep second degree burns, involving 48 per cent of skin surface, with many third degree areas over the lower extremities, bilateral blast injuries of the lungs, blast injury of mediastinum (hemorrhage?), traumatic perforation of the right ear drum, and temporary psychosis. This man was admitted on January 3, 1944, and discharged greatly improved to another hospital on January 25, 1944, by ambulance. At this time he felt well, his lungs had cleared and he was apparently mentally normal.

Case IV. While standing in line near the galley passageway, this sailor saw a flash and was lifted from the floor. He reached the outside deck without aid although he remembers no details. He was then told that his left thigh was bleeding severely. Shortly thereafter he lost consciousness and was revived only after admission to this hospital. Injuries involved bilateral fractures of the first ribs, anterior to the tubercles, deep second degree burns, involving 82 per cent of the body surface with numerous third degree areas, large (12 inch by 2 inch) laceration-avulsion of the left thigh, and traumatic perforation of the left ear drum. This sailor was admitted on January 3, 1944, and was discharged greatly improved on February 1, 1944, by ambulance.

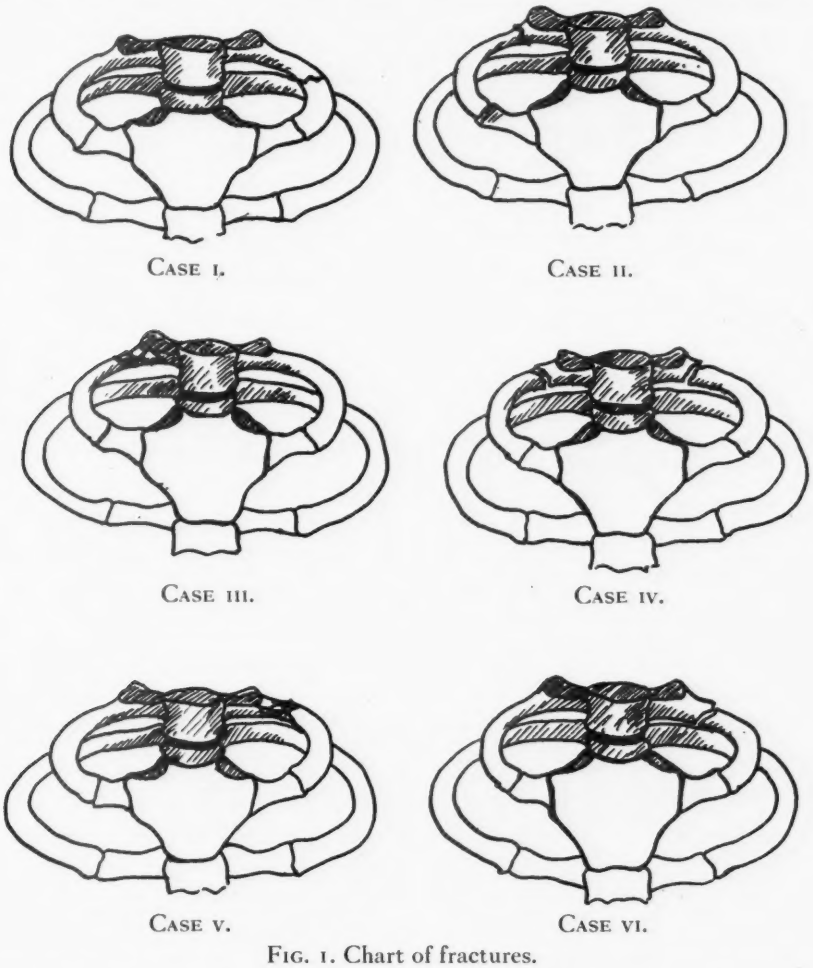

Fig. 1. Chart of fractures.

Case V. While waiting in line in the galley passageway, this sailor heard an explosion and felt stunned. He recovered consciousness on the floor and saw numerous glowing lights. His mind was clear but he was unable to move for a short time, and felt numb. When able to move he went aft to the open deck. There he missed a step and sat heavily on the deck, following which he was evacuated to the Coast Guard boat. His injuries included comminuted fracture of the left first rib posterior to the tubercle, deep second degree burns, involving 65 per cent of skin surface, with numerous third degree areas, bilateral traumatic perforations of the ear drums and several foreign bodies in the right eye. He was admitted on January 3, 1944, and was discharged by ambulance to another hospital in a greatly improved condition and able to walk on January 25, 1944.

Case VI. This sailor, while waiting in line in galley, heard an explosion and was forced against a wall by it. He felt repeated electric shocks and was thrown to the floor, unconscious. Upon reviving he was unable to move, but was assisted to the deck and evacuated to

a Coast Guard boat. Examination revealed fracture of the left first rib just anterior to the tubercle, deep second degree burns, involving 50 per cent of the body surface, with numerous areas of third degree burns, traumatic perforation of the right ear drum, and laceration of forehead. He was discharged on January 25, 1944, to another hospital, ambulatory.

All of the above cases were critically ill on admission to the hospital. Strenuous therapy for their burns was primary. Chest *x*-rays were indicated immediately in Cases I and III because of severe hemoptysis, and later in Case IV when mild transitory hemoptysis was observed and in Cases II, V and VI because of chest pains.

INCIDENCE

Judging from the infrequency with which cases of isolated fractures of the first rib appear in the literature, this injury is a rarity. However, this impression must be tempered with the understanding that, unless complications occur, the course is very benign, localizing symptoms very obscure and mild, and the causative injury or force frequently diffuse. Hence, cases may be easily missed. In 1935, Oldfield described a case of bilateral first rib fracture, and referred to ten cases of unilateral fractures reported by Friedl. One of these ten cases was bilateral. In 1937, Breslin found twenty-seven cases in the literature and added five of his own. In 1938, Outland and Hanlon reported one case. Another case was reported by Aitken and Lincoln in 1939. In 1943, Cohen reported three cases found during routine chest *x*-ray studies in 3,000 selectees.

ANATOMY

To understand the mechanics, symptoms and complications of this fracture, knowledge of the local anatomy is essential. The first rib is the shortest and the most fully curved. It has the shortest costal cartilage. Its position differs markedly from that of the other ribs in that, instead of having inner and outer surfaces and upper and lower borders, it has upper and lower surfaces and inner and outer borders. These factors all contribute to the rigidity of its position and lack of resiliency as compared with that of the other ribs.

The curve of the rib is compounded at the tubercle by a secondary downward curve toward its vertebral attachment. This portion of the rib is also markedly thinned. At the junction of the vertebral two-thirds with the sternal third of the rib, on its upper surface, is the tubercle for insertion of the scalenus anticus muscle. In front of this tubercle is a groove for passage of the subclavian vein, and behind it a similar groove for passage of the subclavian artery. Behind this groove for the artery is the site of insertion of the scalenus medius muscle. At this site the first interdigitation of the serratus anterior muscle takes origin from the outer margin of the rib. Other muscles that are attached to the rib, but are of little importance are the subclavius, which takes origin from the anterior end of its upper surface, and the intercostals. The brachial plexus emerges between the scalenus anticus and medius and crosses the first rib, separated from it only by the lowest fibers of the scalenus medius muscle and the subclavian artery. The inner border of the rib is in contact with the parietal pleura overlying the upper lobe of the lung. Anteriorly, the costal cartilage of the first rib is attached to the upper lateral angle of the manubrium and to the clavicle.

The first rib is protected anteriorly and above by the clavicle, anterolaterally by the coracoid process, so forming a relatively deep recess for it, which is covered by the pectoralis major muscle. Lateral protection is afforded by the neck and acromion process of the scapula and by the humerus. Posteriorly, the scapula shields the rib without covering it. However, in this region it is covered by thick layers of muscle. These include the trapezius, levator scapulae and rhomboid minor, splenius capitis and cervicis, and the erector spinae.

The possibility of pressure applied to the clavicle where it crosses the first rib forcing

it back against the rib and so fracturing the latter without fracturing the clavicle may be eliminated with realization that a distance of at least one-half inch separates the two bones, and this space is cushioned by the subclavius muscle and costocoracoid membrane. This latter relatively firm structure tends to stabilize the local bony relationships by its tense bracing position between the first rib, clavicle and coracoid process.

This rib is most subject to fracture at and posterior to the tubercle where it becomes thinner and descends to its vertebral attachment. The vascular grooves also are relatively weak sites.

MECHANISM OF FRACTURE

Reference to the pertinent anatomy, as described in the preceding section, makes obvious the conclusion that fracture of the first rib by direct force is practically impossible without very severe injury to the overlying structures. However, indirect force from diffuse pressure to the chest transmitted to the first rib through the sternum may well cause its injury. This is the mechanism that is believed to have caused the fractures herein reported. The blast force applied against the chest causes fractures where the thoracic wall resiliency is least, that is at the first rib.

Several cases reported in the literature suggest muscle action to be the etiologic factor. This may be understood by visualizing the points of rib fixation at the vertebral and sternal ends and where the subclavian artery and vein cross it. Sites of upward forces are at the insertions of the scalenus anticus and medius muscles. With such muscle pull suddenly and strongly applied, fracture may well occur at the anatomic weak points, at and posterior to the tubercle where the rib is thin and at the sites of vascular crossings.

SYMPTOMS

Symptoms of the fractures were very few in this series. In fact, the condition was not diagnosed or even suspected before roentgenography. The *x*-rays had been ordered because of frank hemoptysis in two cases (blast injuries to the lungs), bloody sputum in a third, and severe diffuse chest pains in the other three. In none was pain reconciled to the position of the first rib.

COMPLICATIONS

Reference to the anatomy indicates how brachial plexus or major vascular injuries may be incurred. In the literature several cases of abscess formation have been cited. Possibility of injury to the underlying lung and pleura exists as with any other rib fracture. One of our patients developed a bloody sputum on his fourth day of hospitalization. He complained of no pain, although at that time he was swathed in bandages, and because of the discomfort of multiple injuries, may not have recognized the local discomfort due to the lung injury if such existed. Because of this hemoptysis, an *x*-ray of the chest was ordered, and bilateral fractures of the first ribs found. However, we cannot say definitely that the fractured ribs caused the hemoptysis which ceased within twenty-four hours.

TREATMENT AND PROGNOSIS

No specific treatment for this condition is required. The patient should avoid all physical activity that may cause sudden, forceful movements of the neck for a period of one month. Complications are handled as they arise. The prognosis is excellent; untoward sequelae are more likely to be due to complications than to the basic fracture.

CONCLUSION

Six cases with seven isolated fractures of the first rib have been reported. The mechanism of these is attributed to the indirect force transmitted to the first rib from the blast pressure against the thoracic

cage. In each case the diagnosis was made after *x*-ray examination for other thoracic complications revealed this fracture to be present. No complications were had and no specific treatment given.

REFERENCES

1. Aitken, A. P. and Lincoln, R. E. Fracture of the first rib due to muscle pull. *New England J. Med.*, 220: 1063, 1939.
2. Breslin, F. J. Fractures of first rib unassociated with fractures of other ribs. *Am. J. Surg.*, 38: 384, 1937.
3. Cohen, A. G. Isolated fracture of the first rib. *New York State J. Med.*, 43: 448, 1943.
4. Friedl, E. Quoted by Oldfield from *Röntgenpraxis*, vol. 881, 1933.
5. Oldfield, M. C. *Brit. M. J.*, 2: 839, 1935.
6. Outland, T. and Hanlon, C. R. Fracture of the first rib unassociated with fracture of other ribs. *J. Bone & Joint Surg.*, 20: 492, 1938.

Cervical polyps are small pedunculated tumors which arise usually from the intracervical mucosa, but which may at times spring from the external or vaginal surface of the cervix. They are single or multiple, usually of bright red color, and of rather fragile, spongy structure.

SPONTANEOUS RUPTURE OF THE SPLEEN

TWO CASE REPORTS

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THE literature is replete with case reports of traumatic and spontaneous rupture of the spleen, particularly in the last two decades. Several of these reports have related spontaneous rupture of the normal organ in which no history of trauma could be elicited. A case reported by McCoy even occurred during sleep. The mechanism of rupture is somewhat a point of conjecture insomuch as two principal types of disorder are found: (1) The convex surface of the spleen which is the usual site of rupture presents a subcapsular hematoma which may itself rupture with consequent hemorrhage into the peritoneal cavity; (2) the tear occurs in one of the fissures or through the parenchymal substance of the spleen without subcapsular hemorrhage.

Many case reports of spontaneous rupture have been related in diseased spleens. The conditions mainly responsible are typhoid fever, malaria, mononucleosis, tumors, cysts, torsion of the pedicle, and others. "Spontaneous" rupture infers that there has been no history of trauma or that the degree of trauma has been so insignificant that it may not be considered a causative factor. Of interest is a group of forty-six cases reviewed by McIndoe in 1932 presenting delayed hemorrhage following minor physical effort or injury. In any of the pathological entities reported, the degree of splenomegaly and the bogginess of the splenic pulp would seem to predispose the organ to spontaneous rupture.

The following cases are examples of diseased spleens in which spontaneous rupture occurred. In both, there is no real history of trauma. Signs of intraperitoneal hemorrhage were recognized promptly, and both were subjected to successful laparotomy. King, in 1941, reported the only other case of ruptured spleen in infectious mononucleosis that could be found in the literature. Although neither of these cases presented accessory spleens, one should always be mindful of Curtis and White's observation that accessory spleens occur in 10 per cent of all autopsies, and that rupture of an accessory organ is not uncommon.

CASE REPORTS

CASE 1.* E. B., a twenty-eight year old white male, was admitted to the hospital October 11, 1943. He stated that he felt tired and listless since October 1st and that since October 8th he had suffered with epigastric discomfort and fever. The past history was irrelevant except that he had measles, mumps, chicken pox and pertussis in childhood. He suffered episodes of non-specific prostatitis in 1942 and 1943.

Examination revealed a well developed male, being 71 inches tall and weighing 165 pounds. There was a slight icterus of the sclerae and mucous membranes, and there was mild redness of the pharynx. Widespread lymphadenopathy was present, particularly in the axillary and cervical regions, and there was a very prominent submental node. There was mild tenderness in the epigastrium and the spleen was barely palpable.

A diagnosis of acute mononucleosis was made and confirmed by the finding of 17,450 white blood cells of which 72 per cent were lymphocytes and 20 per cent monocytes. The heterophile antibody test was positive in a dilution of 1:1280 on October 12th. Icterus index at this time was 12. The cholesterol flocculation test was 4+ and prothrombin time was 95 per cent of average normal.

* This case is being presented in detail elsewhere by Ochs, Banks and Benenson.

His progress was uneventful until October 18th when suddenly, at 11 A.M. without any known injury, he went into shock. There was severe epigastric pain referred to the left shoulder, cold clammy skin, a blood pressure of 80/60, and pulse of 100. A diagnosis of ruptured spleen was made and the patient given 2,000 cc. of plasma until blood could be collected for transfusion. He was taken to the operating room at 3 P.M., and under bilateral novocain intercostal block and supplemental pentothal sodium, a high right rectus incision was made. The peritoneal cavity was filled with fluid and clotted blood, 1,000 cc. of which was recovered for autotransfusion. The spleen was found to be enlarged about three times normal size and was extremely boggy and friable. There was a large subcapsular hematoma over the convex surface which had ruptured. Splenectomy was easily performed. A transfusion of an additional 2,950 cc. of blood was administered. Convalescence thereafter was uneventful and the patient was discharged from the hospital on the twenty-third postoperative day. The mononucleosis was cured by the fifth postoperative day with the following hematologic findings: red cells, 2,940,000; white cells, 14,000; hemoglobin, 65 per cent; 85 per cent polymorphonuclears, 6 per cent lymphocytes, and 7 per cent eosinophiles.

The pathological report (gross) was as follows: The specimen consists of a spleen which is definitely enlarged measuring approximately 19 by 11 by 2.5 cm. It is characterized by a huge rent extending from the upper pole into the midzone in a ragged serrated contour. This tear penetrates the substance of the spleen for a distance of 2 cm. The capsule is thin and the consistency of the organ is almost semi-fluid. Manipulation of the spleen results in penetration without any pressure on the capsule. (Microscopic): Section shows almost total absence of trabeculae. These are reduced to strand-like structures of their composing cells. The persisting trabeculae show active mobilization of the cell components into histiocytes, monocytes, and plasma cells. There are great numbers of these named cell elements crowding the sinusoidal spaces. Myelocytes are seen rather infrequently. The capsule of the spleen seems to have undergone a cellular dissipation to such an extent that the capsule is composed of a single cell layer. Vascularity does not appear to be increased and the number of red blood cells seen in the sinusoidal spaces is not abnormal. Pathological Diagnosis: Reticulo-endothelial hyperplasia of the spleen with mobilization of fixed tissue elements.

Case 11. W. A. Y., a white male, age twenty-nine, was admitted to the hospital December 18, 1942, with a complaint of sudden acute epigastric pain spreading over the entire abdomen. This was followed by nausea and vomiting and two watery bowel movements. During the sixteen hours between the onset of symptoms and the time of admission to the hospital pain became progressively more severe. There was no history of previous gastrointestinal disturbance.

Examination revealed a well nourished and well developed male weighing 162 pounds. His respiration was greatly increased due to apparent abdominal pain. The blood pressure was 120/84. The abdomen presented generalized board-like rigidity which was more pronounced over the upper half.

His preoperative laboratory work consisted of a blood count and urinalysis. There were 3,790,000 red blood cells, 26,150 white blood cells, 92 per cent polymorphonuclear cells, and a hemoglobin of 76 per cent. On the basis of the white count, the examining surgeon made a presumptive diagnosis of acute appendicitis.

He was taken to the operating room and a McBurney incision revealed free blood in the peritoneal cavity and a normal appendix. The McBurney incision was closed and a high right rectus incision substituted. Exploration revealed splenic rupture and removal of the organ was easily accomplished. He was given a transfusion of 1,000 cc. of whole blood while on the operating table which supported his dropping blood pressure. Convalescence was complicated by a hypostatic pneumonia but the patient recovered satisfactorily and was discharged on the twenty-fifth postoperative day.

The pathological report (gross) was as follows: The specimen consists of a moderately enlarged spleen weighing approximately 200 Gm. The inferior and lateral aspects are greatly roughened by blood clots and hemorrhage. Elsewhere the capsular surface is slate gray, smooth, and glistening. Upon section the reddish-brown, moderately-firm pulp contains a number of dark purplish-red hemorrhagic nodules. Some of these approach and project slightly from the capsular surfaces and the

roughened area mentioned above. These apparently represent the source of the abdominal bleeding. The nodules vary in size from a few millimeters up to 1 to 2 cm. and vary from circular to ovoid in shape. (Microscopic): There are nodular masses of thrombotic and hemorrhagic extravasation into relatively normal splenic pulp. The immediate surrounding pulp does not show evidence of compression as would be expected from expanding hemorrhage. Small tongue-like processes of pulp tissue may be seen partially subdividing some of the hemorragic areas. Some of these areas encroach upon and perforate the capsule. Pathological Diagnosis: Multiple hemangiomas of the spleen with perforation of the capsule.

SUMMARY

Two cases of spontaneous rupture of the spleen are reported: one in a case of infectious mononucleosis with splenomegaly, the other in a spleen with multiple hemangiomas. King, in 1941, presented the only other case of splenic rupture in mononucleosis reported in the literature. Both of the cases presented herein recovered following splenectomy.

REFERENCES

1. BYFORD, W. H. Spontaneous rupture of the normal spleen. *Arch. Surg.*, 20: 232–239, 1930.
2. CANTIN, Y. Torsion of the spleen; associated with rupture. *Lancet*, 2: 1175, 1935.
3. CHI, C. K. Spontaneous rupture of the normal spleen. *Chinese M. J.*, 56: 374–378, 1939.
4. CONNER, L. A. and DOWNES, W. A. Spontaneous rupture of the spleen in typhoid fever with report of a case cured by operation. *Am. J. Med. Sc.*, 147: 332, 1914.
5. CURTIS, G. M. and WHITE, P. L. Surgical significance of accessory spleen. *Tr. West S. A.*, 46: 364, 1937.
6. DUDGEON, H., JR. Spontaneous rupture of the spleen. *South. M. J.*, 34: 1247–1249, 1941.
7. FOSTER, JOHN M., JR. and PREY, DUVAL. Rupture of the spleen. *Am. J. Surg.*, 47: 487–501, 1940.
8. LEIGHTON, W. E. Spontaneous rupture of a malarial spleen with abstract of cases reported between 1842–1921. *Ann. Surg.*, 74: 13, 1921.
9. MCCOY, J. C. Splenectomy for rupture of the spleen; report of 4 cases. *Ann. Surg.*, 54: 597, 1911.
10. MCINDOE, A. H. Delayed hemorrhage following rupture of the spleen. *Brit. M. J.*, 20: 249, 1932.
11. NOLAND, L. and WATSON, F. C. Spontaneous rupture of the malarial spleen; report of 3 cases. *Ann. Surg.*, 57: 72, 1913.
12. WATSON, J. R. and FERDEBER, M. Spontaneous rupture of the normal spleen. *J. A. M. A.*, 120: 690–691, 1942.
13. WILLIS, A. M. Traumatic rupture of the normal spleen. *Surg., Gynec. & Obst.*, 29: 33, 1919.
14. YOUNG, RALPH H. Spontaneous rupture of a normal spleen. *Ann. Surg.*, 101. 1389–1392, 1935.

EXTENSIVE PILONIDAL CYST*

CASE REPORT

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RECENTLY a large number of papers have appeared concerning the treatment of pilonidal sinus and cyst.[1,3-4,5,6,7,8,11,12,13,14,16,17] The methods of treatment vary, although most authors discuss different means of obliterating the dead space after excision, others present radical departures from the usual therapy.[2,9] At this hospital, the premise is followed that each case is a problem within itself and so the procedure for each patient is individualized as the characteristics of the lesion indicate. The case reported here was a patient with a large pilonidal cyst with extensive ramifications of the secondary tracts requiring radical excision to obtain a satisfactory result.

CASE REPORT

The patient was a thirty-eight year old white man who entered the hospital because of pain and discharge about the anus. One year before, the patient had an anal abscess which required incision and drainage by his physician. Healing took place after about three months and the patient had no further difficulty until two months before his admission here. At this time he had noted severe aching pain about the anus. For two weeks before admission there had been a discharge of purulent material without decrease in pain. The family and past histories were non-contributory.

The general physical examination showed no abnormalities. To the left of the anus was a triangular scar in which there were three small openings, with another opening just posterior to the scar. Moderate redness, swelling and tenderness were present about the anterior limb of the scar. In the midline posteriorly was a fifth opening, and to the right of the anus was a sixth opening. Pressure on the swollen area produced a purulent discharge from the openings posteriorly and on the right. A slit-like opening, in which hair could be seen, was present just below the tip of the coccyx and ten more openings were scattered over the sacrococcygeal area. By limited gentle probing, the tracts were all found to communicate with one another.

Clinical laboratory finding showed a red blood cell count of 3,940,000, hemoglobin 70 per cent (Talquist), white blood cell count 8,850 with 76 per cent polymorphonuclear forms. The urinalysis was negative; Kahn test was negative. Culture of the purulent discharge showed Bacillus aerobacter aerogenes.

The patient was given sitz baths twice daily and mineral oil each evening. The inflammatory reaction rapidly subsided and the discharge decreased. Operation was done under spinal anesthesia on the seventh hospital day. A careful search was made for an internal (or primary) anorectal opening but none could be found. The fistulous tracts about the anus, including a cystic area posteriorly, were first excised. The end of the strand of hair was found protruding into this posterior cyst. The cyst and tracts over the sacrococcygeal region were then excised, which necessitated dissection down to the sacrococcygeal fascia. The plan had been to leave a bridge of intact skin in the region of the coccyx by tunneling subcutaneously, but this was found impracticable because of the superficial tract in this area. The connecting tract containing the strand of hair was therefore excised completely. Because of the anticipated difficulty in healing, an attempt was made to reconstruct a bridge of skin and subcutaneous tissue at the level of the coccyx. Two sutures of silkworm gut were placed through the skin and through the fascia over the coccyx. The skin for a distance of about 3 cm. was approximated with interrupted fine silk. The remaining open areas lying above and below the coccyx were loosely packed with gauze moistened with azochloramid.

Pathologic study showed foci of inflammatory cell infiltration, especially of round cells,

* From the Surgical Service of the Station Hospital, Fort Myer, Virginia, Colonel M. F. DuFrenne, Commanding.

throughout. There were a number of tracts traversing the subcutaneous tissue, which were lined with squamous epithelium and contained hairs. Some of these showed inflammatory reaction. There was also a larger tract lined by granulation tissue with many polymorphonuclear and giant cells in addition to the round cells.

The wound was dressed every other day and the packs replaced. At the end of ten days, the bridge of tissue over the coccyx was firmly healed with union to the coccygeal fascia. There was very little discharge and healthy granulation tissue was present in the open areas. Following this, an ointment containing 6 per cent sulfanilamide and 10 per cent cod liver oil in lanolin was applied daily. Progress thereafter was very rapid. Twenty-eight days after operation, the upper half of the wound was almost healed and the lower half was two-thirds healed. Eleven days later healing was complete and the patient was discharged from the hospital. He has remained well to date.

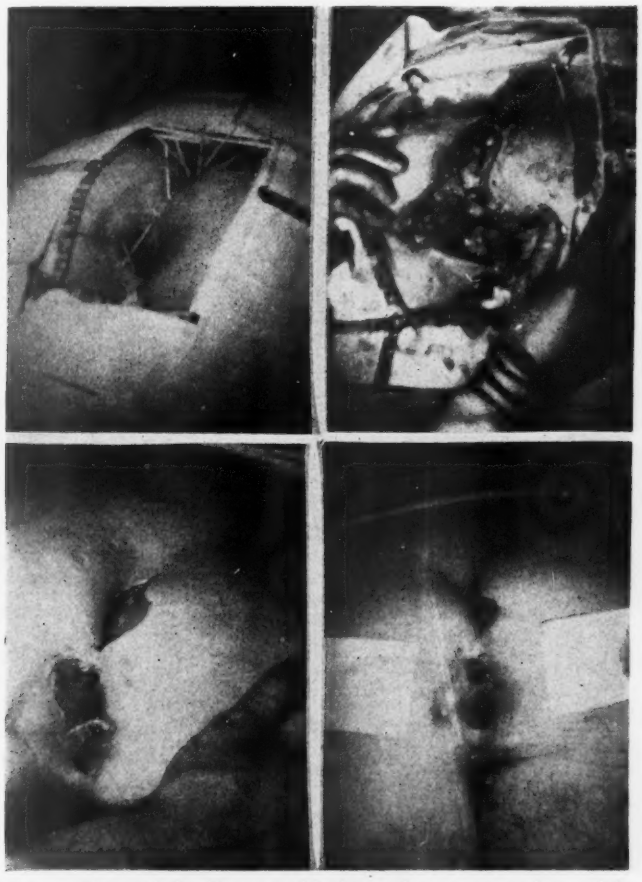

FIG. 1. Upper left: Extent of lesion prior to operation, with applicators in larger openings; upper right: extent of wound after excision; lower left: healing fourteen days after operation; lower right: twenty-eight days after operation, healing nearly complete.

COMMENT

The recent excellent summary by Kooistra[10] makes any review of the literature unnecessary here. Several features of the reported case were interesting. The extent of the lesion was unusual. When the patient was first seen, a diagnosis of fistulo-in-ano and pilonidal cyst was made. This combination has been reported by Warman.[15] As no internal opening could be found at operation, it was apparent that the extension was entirely from the pilonidal cyst. The advantage of leaving a bridge of intact tissue in the region of the coccyx when the tract extends in this direction has been

noted by others in the treating of fistulo-in-ano, and a two-stage operation may be preferable to opening this entire area because of difficulty in healing. Fortunately, firm union resulted in the sutured tissue of this case, and this was an important factor in hastening final healing. The preparation of sulfanilamide and cod liver oil in lanolin was modified from the formula suggested by Brezin.[3] This also aided greatly in the healing process as evidenced by the small amount of discharge and the rapid growth of firm healthy granulation tissue.

REFERENCES

1. Adcock, David F. Pilonidal cyst. *J. South Carolina M. A.*, 38: 109, 1942.
2. Biegeleisen, H. I. Sclerotherapy for pilonidal cyst. *Am. J. Surg.*, 44: 622, 1939.
3. Brezin, David. Pilonidal cyst. *Am. J. Surg.*, 59: 18, 1943.
4. Brezin, David; Love, Carruthers and Lawrence, Joseph. Pilonidal cyst. *Am. J. Surg.*, 60: 264, 1943.
5. Cohn, Isidore. An operation for pilonidal sinus. *Am. J. Surg.*, 61: 61, 1943.
6. DePrizio, Carl J. Pilonidal cyst and a new improved type operation. *Mil. Surg.*, 91: 292, 1942.
7. Dunphy, J. E. and Matson, D. D. The treatment of pilonidal sinus. *Surg., Gynec. & Obst.*, 75: 737, 1942.
8. Jacobs, Raymond G. Observations of pilonidal cysts. *U. S. Naval Med. Bull.*, 41: 1296, 1943.
9. Jacobson, Philip. A new method for eradicating congenital sinuses by electrocoagulation and steam, with special reference to pilonidal sinuses. *Virginia M. Monthly*, 69: 206, 1942.
10. Kooistra, Henry P. Pilonidal sinuses. *Am. J. Surg.*, 55: 3, 1942.
11. Lane, Warren Z. Pilonidal cysts and sinuses in the navy. *U. S. Naval Med. Bull.*, 41: 1284, 1943.
12. MacFee, William F. Pilonidal cysts and sinuses. *Ann. Surg.*, 116: 587, 1942.
13. Pickett, William J. and Beatty, Arch J. Pilonidal cysts in the army. *Am. J. Surg.*, 56: 375, 1942.
14. Scott, James V. Pilonidal cyst, the local use of buffered sulfanilamide in primary closure. *Ann. Surg.*, 117: 191, 1943.
15. Warman, W. Merle. A case of fistula in ano with pilonidal sinus. *West Virginia M. J.*, 32: 80, 1936.
16. Weeks, Richard B. and Young, George G. Sacrococcygeal cysts. *Am. J. Surg.*, 60: 260, 1943.
17. Woldenberg, S. C. and Sharpe, W. S. Surgical treatment of pilonidal (dermoid) cysts. *Surg., Gynec. & Obst.*, 76: 164, 1943.

A FOREIGN BODY BETWEEN THE RECTUM AND BLADDER

CASE REPORT

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FOREIGN bodies are frequently found in the intestinal tract and their presence is explained in one of five ways: (1) They were swallowed; (2) they were introduced through the anus; (3) they were formed within the intestine; (4) they entered by some pathologic process from another organ, and (5) they got into the intestinal tract as a result of a violent injury.

There are many reports in the literature of foreign bodies swallowed intentionally, for the most part by insane persons, or accidentally, usually with the knowledge, but often without the knowledge, of the patient. When the object is swallowed without the patient's being aware of so doing, the symptoms of which he complains are varied; and these patients present great difficulty in diagnosing the source of their trouble. Symptoms vary with the nature of the object swallowed and with the portion of the intestine in which the object is arrested. Many of the objects, even though sharp, pass through the alimentary tract without causing any symptoms, while others cause slight pain, intense pain, serious injury to the gut, resultant peritonitis and death. Swallowed objects are most often arrested in the esophagus, pyloric orifice, duodenum, ileocecal valve, somewhere in the flexures of the large bowel, and last and most frequently in the anus.

In a cursory search of the literature six interesting cases of a sharp object in the intestinal canal were noted. There are many more in the literature and a still greater number which were never reported, but these six reports are of special interest.

Smith[1] published a report of a darning needle found in the appendix by Mr. Christopher Martin which was shown before the Midland Medical Society, November 12, 1919. Although the patient had no explanation for the presence of the needle, the symptoms of which she complained during the preceding twenty years indicated the course of the needle through the alimentary canal. In 1897, she suffered from indigestion and a diagnosis of gastritis was made. In 1907, the patient had a violent attack of hematemesis, vomiting about two pints of blood and she nearly died. Subsequently, she suffered from occasional recurrences of epigastric pain. In July, 1913, about a month before the needle was found, she had an attack of pain in the region of the duodenum. A medical man whom she consulted thought the pain might be due to appendicitis. She has had no recurrence of symptoms since the removal of the needle.

Akers[2] reports the case of a man who had a pin in the rectum for thirty years. Symptoms of pain of a pricking character in the rectal region on sitting down, constant desire to defecate, great pain on defecation with the stools small, pipe-like and streaked with blood, had been present for more than thirty years. The pin was found just within the anus above the sphincter muscles. After the pin was removed all symptoms subsided. The patient was unable to account for the presence of the pin.

Carp[3] in a review of forty-eight proved cases of foreign body in the intestine, cites the case of a child who swallowed a pin, which caused death from peritonitis. He found that a sharp object took from two days to three weeks to go through the intestinal tract, and says that in order of frequency the rectum, cecum and sigmoid offer the best anatomical sites for the arrest of foreign bodies. He concludes that a foreign body may travel from the intestine into another organ, or into the peritoneal cavity and from there into muscle planes with little or no symptoms.

FIG. 1. *X*-ray before proctoscopy showing the pin at the level of the lowest sacral vertebra.

FIG. 2. *X*-ray taken after proctoscopy showing pin in a more transverse position at the level of the lowest sacral vertebra. The pin is slightly bent.

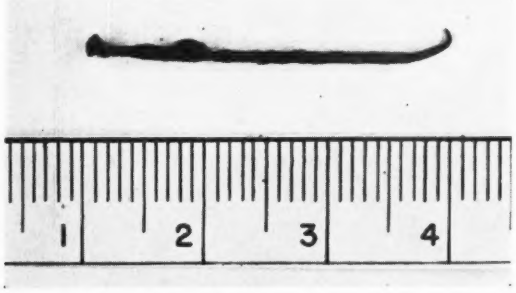

FIG. 3. The ordinary pin is about 2½ cm. while this pin is slightly over 3 cm. in length.

David[4] reports a case of a fish-bone which was swallowed and was passed through the urethra.

Cordier[5] reports the case of a boy, sixteen years old, who for two or three years complained of symptoms pointing to the bladder. He had pain in the right inguinal region and great tenderness extending to the median line, which at first was diagnosed as typhoid fever. On passage of a sound into the bladder a stone was felt. At operation two stones were found, one about the size of a pigeon's egg and a second suspended from the fundus by a short veil-pin protruding into the bladder. A fecal concretion was attached to the head of the pin.

Mueller,[6] in a report before the Philadelphia Academy of Surgery, tells of a thirty-four year old female who swallowed a pin which was removed nine years later. She complained of pain in the loin and in the right iliac fossa, together with frequency of urination. An *x*-ray revealed a stone in the lower pole of the right kidney and a pin at the level of the sacro-iliac joint, lying in the course of the ureter. Removal of

the kidney stone and the pin allayed all symptoms.

CASE REPORT

The case we are presenting was a male, A. H., aged twenty-six years, admitted to the Norwegian Hospital on November 20, 1942, with a diagnosis of foreign body in the recto-vesical space. The chief complaint was pain in the low back of a week's duration. The pain was increased on sitting or walking. The past history and family history were irrelevant.

On November 13th, while working in a shipyard, the patient felt pain in the lower back radiating to the coccyx. *X*-ray revealed a foreign body of the shape and size of a long pin, lying in the middle of the lower pelvis. (Fig. 1.)

Physical examination revealed the blood pressure to be 120/80. The general appearance was that of a young, adult male, well developed and apparently in good health. The pupils reacted to light and accommodation. The tonsils were normal. The heart, lungs and abdomen revealed nothing abnormal. The genitourinary system showed nothing of note.

On November 20, 1942, a proctoscopic examination by one of us (C. G.) revealed three ulcers, varying in size from ¼ to ¾ cm. just below the level of the rectosigmoid, which bled slightly on touching with an applicator. There were some feces in the rectum which were removed by enema. A sharp object which was between the bladder and rectum was felt with the end of the proctoscope, anterior to and outside the rectum. Because of the uncertainty of the exact position of the object with reference to the peritoneal reflection, it was thought best not to attempt its removal through the rectum. After finishing the proctoscopic examination another *x*-ray revealed the object still present, anterior to the rectum, with its position slightly changed. (Fig. 2.)

Cystoscopic examination by one of us (F. O.) failed to reveal the pin in the bladder.

On November 23rd, an exploratory laparotomy was performed. The bladder was distended with fluid through a catheter, which was permitted to remain *in situ*. A midline incision was made extending from below the umbilicus to just above the symphisis. The rectae muscles were separated, the peritoneum opened and the pelvic structures inspected. To the left of the midline, on the posterolateral surface of the urinary bladder, a dimpled area with injected edges was noted running in a transverse direction. Palpation of this area revealed the presence of the pin. An elliptical incision was made in the peritoneum, enclosing the pin, and the pin with the surrounding tissue was excised. The bladder was then repaired with No. 00 chromic, purse-string suture, and the peritoneum closed with No. 00 plain gut. The abdomen was closed with black silk. (Fig. 3.)

The patient was discharged from the hospital on December 4, 1942, symptom free. He has since been inducted into the armed forces.

SUMMARY

1. Several interesting cases of the presence of a sharp object in the intestinal tract are noted.

2. A case is reported of a young, adult male, in whom the *x*-ray showed the unexplained presence of a long pin, lying between the bladder and rectum.

3. The authors are unable to explain the symptoms of which the patient complained by the presence of the pin in the position in which it was found.

REFERENCES

1. Smith, Heywood. A needle in the alimentary canal. *Brit. M. J.*, 1: 81, 1920.
2. Akers, W. D. Pin in the rectum for thirty years. *Lancet*, 2: 690, 1898.
3. Carp, Ralph. Foreign bodies in the intestines. *Ann. Surg.*, 85: 575–591, 1927.
4. David, I. An errant fishbone. *Brit. M. J.*, 1: 166, 1918.
5. Cordier, A. H. Some unusual surgical cases. *J. Clin. Med.*, 14: 1001, 1907.
6. Mueller, George P. Foreign body removed from abdomen nine years after it had been swallowed. *Ann. Surg.*, 67: 380–382, 1918.

OBTURATOR HERNIA*

REPORT OF A SUCCESSFUL OPERATION IN AN EIGHTY-THREE YEAR OLD WOMAN

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OBTURATOR hernia was first observed by Arnaud De Ronsil in 1724 when he reported one case before the French Academy of Science in Paris. Later in 1768 a case was reported by his son G. Arnaud De Ronsil and this was the first instance in which a strangulated obturator hernia was reduced successfully by taxis.

Laparotomy for strangulated obturator hernia was first performed by Hilton in 1848. Dr. Leigh R. Watson collected from the literature 420 cases up to 1938 and reviewed the histories of 396 of these cases. He found it occurred with equal frequency on the right and left sides; in twenty-one cases it was bilateral. The diagnosis was rarely made before operation or necropsy and the Howship-Romberg sign was noted in sixty-eight cases. The mortality was very high, 151 out of 228 cases.

Obturator hernia, as the name suggests, is a hernia that descends through the obturator foramen or canal and the sac may occupy several positions although it commonly follows the course of the vessels. The sac is formed by peritoneum and usually contains small intestines. The size of the sac is small because of the resistance offered by the obturator and the pectineus muscles as well as the obturator membrane and the narrow canal. This type of hernia is most common in old, emaciated women, due to the relaxation of peritoneum from pregnancies, the loss of fat, the greater size of the obturator foramen and the shape of the pelvic canal.

The predisposing causes are those conditions that produce abnormal increase in the intra-abdominal pressure as emphysema, asthma, chronic coughs, laborious occupation and lifting heavy objects.

The diagnosis of simple reducible obturator hernia is seldom made. Where strangulation is present the symptoms are those of intestinal obstruction, the most common and important diagnostic finding is the numbness, burning sensation and pain on the inner thigh down to the knee which is produced by pressure on the obturator nerve. This sign was first described by Howship in 1840 and later Romberg in 1845 and is known as the Howship-Romberg sign.

On examination a swelling with tenderness may be present in the obturator region below and internal to the femoral ring. This swelling and tenderness sometimes is best detected by pelvic or rectal examination.

The treatment of obturator hernia is operative and the truss should not be used. Where strangulation is present, an immediate operation is recommended without the use of taxis. The abdominal route is the method of choice although few prefer the obturator route. When the latter route is used, sometimes it is necessary to open the abdomen and treat strangulation or hemorrhage.

In the abdominal route a low right or left rectus incision is made and if strangulation is present the intestines are released by gentle traction and the bowel is treated in the regular way. The sac is inverted by picking the lower end with a hemostat. After placing a ligature at the base it is resected. Sometimes it is easier to place several sutures through the sac and allow it to act as a plug for the obturator orifice.

* Read before The Philadelphia Academy of Surgery, January 4, 1942.

If the sac cannot be inverted, the peritoneum is loosened and stitched together.

CASE REPORT

C. D., a white woman, aged eighty-three years, was admitted to the surgical service of Dr. P. A. McCarthy at the Philadelphia General Hospital on October 1, 1942, complaining of pain in abdomen with nausea and vomiting. The abdominal pain began September 29, 1942, two days before admission to the hospital. The pain gradually grew worse and she could not hold anything in her stomach. A physician was called in and he advised her to go to the hospital.

On admission, beside the history of the pain, nausea and vomiting she stated that she had no bowel movement and no passage of gas since the onset of the trouble. She had similar attacks before but none so severe as the present one. She also stated she had a lump in the left inguinal region which came out while standing on her feet and disappeared after lying down. She wore a belt which kept the lump down. She had had no chills, fever or cough prior to the onset of her present illness and no definite history of change in bowel habits.

Due to her general weak condition it was impossible to get a satisfactory past history. When she was first seen at the hospital the pulse was 100, temperature 98°F., respiration 20 and blood pressure 180/105. The physical examination of the head and lungs was negative. There was a loud systolic murmur heard all over the precordial region. The abdomen was distended with visible peristalsis which gave a high pitched tinkling sound on auscultation.

There was no rigidity and no tenderness anywhere over the abdomen and there was no palpable abnormal masses. The liver, spleen and kidneys presented no detectable abnormality. A careful examination was directed toward the inguinal, femoral and perineal regions for possible strangulated hernia but none was found.

The left inguinal ring was markedly dilated but there was no palpable masses. The skin in this region was excoriated from the truss which she used. The extremities were negative and so was the pelvic and rectal examinations.

A flat *x*-ray plate of the abdomen showed a few stepladder shadows and there was an accumulation of gas in the ileum which produced the distention and suggested the possibility of small bowel obstruction. The dilated loops were directed toward the right pelvis which suggested that the disorder might be in that region. The urine was negative and the blood count showed red blood cells 4,210,000, white blood cells 18,950 with 90 per cent polymorphonuclears; hemoglobin was 91 per cent.

The patient was given fluids with 5 per cent glucose intravenously and a Miller-Abbott tube introduced into the stomach. The tube never passed beyond the pyloric orifice although a few hours were spent in the fluoroscopic room trying to guide it into the duodenum. About 11 P.M. that same evening, seven hours after admission, I operated upon the patient under continuous spinal anesthesia. After the patient was anesthetized another thorough examination was made for strangulated hernias but these were not found.

We opened into the peritoneal cavity through a low, right rectus incision. The peritoneum was found to be thin and friable. The small intestines were hyperemic and distended. No pathological condition was noted in the ileocecal fossa. On examining the pelvic cavity a flattened loop of the ileum was observed. This was followed and was found to have passed through the right obturator foramen in the anterolateral region and caused complete obstruction. By gentle traction the small loop of the ileum, about 15 cm. in length, was removed from the foramen and fortunately was still viable. There was a thick fibrous tissue cord which ran from the ascending colon to the femoral ring. This was bisected and had nothing to do with the acute obstruction.

No attempt was made to repair the sac or to close the orifice as the patient was a poor surgical risk and any kind of repair might have caused hemorrhage from some abnormal vessels and delay the operation. The hernia orifice was less than 1 cm. in diameter, as I could not pass the tip of my little finger through it. The abdominal wound was closed by layers with chromic catgut and reinforced by braided silk sutures which included all the layers.

During the operation the patient received 650 cc. of normal saline and 5 per cent glucose. The operating time was forty minutes and it required 75 mg. of novocaine for the spinal anesthesia.

The patient was returned to the ward in good condition with the Miller-Abbott tube in the stomach. She made a splendid recovery and she was discharged November 7, 1942, in good condition.

Since we could not get an adequate history from the patient or her relatives on admission, I asked her before her discharge if she had had any trouble in the right inguinal region. Her answers were typical of the Howship-Romberg sign. For the past two years she had had attacks of pain in the right groin which radiated down the inner thigh to the knee. These attacks came about every one or two months.

The patient was contacted on December 15th and was enjoying good health with no recurrence of symptoms.

In the great majority of cases the microscopic pattern of hyperplasia is a frankly benign one. In a small proportion, however, markedly proliferative and adenomatous pictures are produced, and these have often been mistaken for cancer.

The brief excerpts in this issue have been taken from "Textbook of Gynecology," 2nd ed., by Emil Novak (The Williams & Wilkins Company).

FAULTY INTESTINAL ROTATION

CASE REPORTS

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TWO cases involving faulty, third-stage rotation of the intestinal tract have stimulated a review of this subject. It is one which should be of importance to every physician from pediatrician to pathologist.

CASE REPORTS

CASE I. On October 1, 1928, a thirteen year old youth (554 y-28) was brought to St. Mary's Hospital in Rochester, Minnesota, in a motor car. The boy was moribund and died on the litter while in transit to a room. A history of the case revealed that three months previously, while riding in an automobile, the patient had a severe abdominal pain which was relieved by vomiting. Forty-eight hours before being brought to the hospital, the boy again complained of severe abdominal pain which grew progressively worse. Postmortem examination was essentially negative, except for the intestinal tract, which showed a common mesentery for the entire embryologic midgut and volvulus of the gut in the clockwise direction. (Fig. 1.) There was distention and discoloration of the entire midgut from the second part of the duodenum to about the middle of the transverse colon. A diagrammatic sketch was made at the time of postmortem examination. It was evident that there had been an obstructive torsion of the superior mesentery vessels. By untwisting the volvulus it was possible to replace the intestines in their normal position. The postmortem diagnosis was volvulus of the embryologic midgut and failure of the third-stage of intestinal rotation.

CASE II. A male infant three weeks of age (E. T., #14199) was admitted to the Children's Hospital in Chattanooga, Tennessee, on September 19, 1940. A normally delivered, breast fed child, he had vomited after feedings since his fourth day. The vomitus was yellow or green and fecal in odor. The first stools had blood and mucous; later there had been marked constipation.

When admitted, the infant had a distended abdomen with hyperactive, visible peristalsis, dehydration, rectal temperature of 100°F. and a white blood count of 8,350. With intermittent stomach suction, intravenous fluids and transfusions, his condition improved. There occurred attacks of vomiting but constipated stools were obtained by enemas. While hospitalized, there were attacks of abdominal distention, with visible peristalsis and vomiting. This, and a normal colon *x*-ray, made a diagnosis of partial intestinal obstruction from embryologic cause.

The abdomen was explored on October 4, 1940, through a right paramedian incision. There was distention of the small intestine. The duodenum was dark red in color and vomitus of old blood occurred after manipulation. Heavy bands of adhesions (Fig. 2) were found, extended from the root of the mesentery to the jejunum at the duodenojejunum fold. The first part of the jejunum was narrowed but patent. The remainder of the small intestine was negative except for a shortened mesentery, until the lower ileum was explored. There extensive fibrous bands existed between the cecum and lower ileum. There was an extensive Jackson's veil. The constricting adhesions were released and a jejunostomy tube inserted. The infant failed to recover from the operative shock and died in twelve hours. The postmortem examination of the abdomen showed no abnormalities other than the operative findings.

Much of the embryology of the intestinal tract was described by Meckel's publication of Wolff's work,[1] as far back as 1812 and more accurate additions were made by Mall[2] in 1898. In an incomplete review of embryological intestinal literature, it is found that the following writers agree in the principal changes which take place in the development of the intestinal tract:

Arey,[3] Bailey,[4] Broman,[5] Dott,[6] Cunningham,[7] Huntington,[8] Jordan,[9] McMurrich,[10] Mall,[2] Frazier and Robbins,[11] Pernkopf,[12] Hertzler,[13] and Prentiss and Arey.[14]

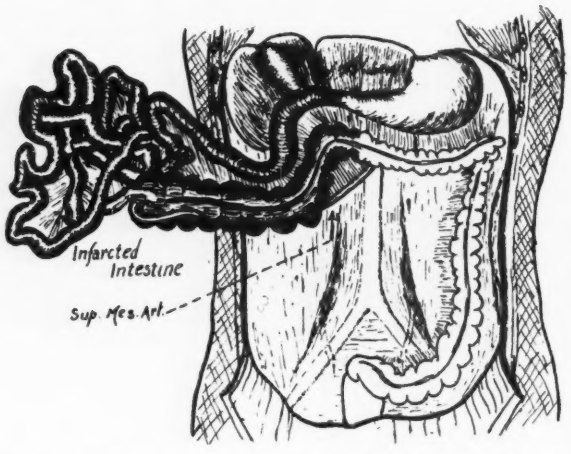

Fig. 1. Volvulus of embryological mid-gut with no peritoneal attachment.

In the state of the primitive streak, an infolding of the entoderm and of the splanchnic layer of mesoderm begins. The edges of the sheets of tissue fuse to form a tube in the longitudinal axis of the embryo. This early intestine is attached throughout its entire length to the posterior wall of the embryo by the future mesentery, and is connected ventrally to the yolk sac by the yolk duct. At this stage of the embryo it is customary to distinguish three parts of the intestinal tract: first, the foregut, which has a ventral as well as a dorsal mesentery; second, the midgut, from which develops the lower part of the duodenum, the remainder of the small intestine and the ascending and transverse colon; and third, the hindgut, from which the remainder of the intestinal tract develops. For this paper, only the midgut is considered.

The midgut increases in length, producing an anterior bend and a lengthened mesentery. The first part of the hindgut grows cephalward and, if not pulled upward, is anchored by a retention band of mesenchymal tissue, described by Frazier and Robbins, by Dott, and by Mall, extending from the root of the superior mesenteric artery to the region of the splenic flexure. The upper part of the hindgut is then nearer the cephalic end of the embryo than the first part of the midgut. Similarly, there is an anchorage of tissue medially from the first part of the duodenum. The midgut is depressed by the umbilical vein which is pulled downward across it by the enlarging liver. A rapid growth of the midgut takes place at this stage of the embryo. Perhaps, due to lack of intra-abdominal space, the midgut is extruded into the yolk sac through the large umbilical opening. This extrusion is referred to as the embryological or physiological umbilical hernia, and is first seen between the 4 mm. and 10 mm. stage of the embryo. The midgut in the umbilical hernia lies outside the abdominal cavity proper and has no contact with other

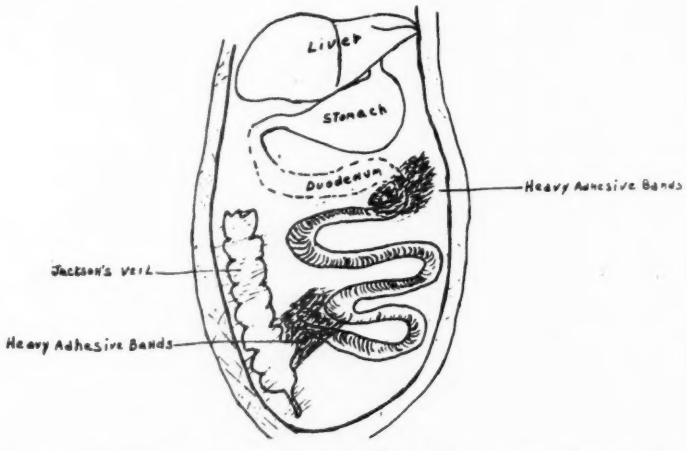

Fig. 2. Diagram of excessive adhesions in third stage of intestinal rotation which caused obstruction.

developing viscera. At approximately the 40 mm. stage of the embryo, the intestines return to the abdominal cavity, and after

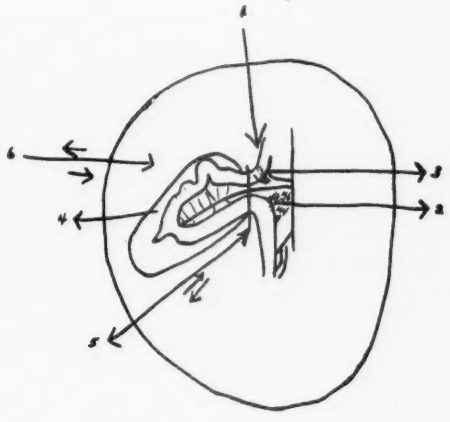

Fig. 3. Diagram of pressures in second stage: 1, liver pressure downward; 2, splenic flexure band; 3, duodenal band; 4, yolk sac with possible adhesions; 5, umbilical orifice; 6, amniotic fluid.

re-entering the abdomen assume the position seen at birth.

The work of Frazier and Robbins, in 1915, divides the stages of midgut rotation into three parts and is generally followed as a classification. The first is during the formation of the umbilical hernia; the second, is the time during which rotation and return into the abdomen takes place; and the third stage represents the peritoneal fusion and fixation. The embryological age of the different stages of intestinal rotation are: first stage, from the formation of the straight enteric canal to the stage of extrusion into the physiological hernia (4 to 10 mm. embryo). The second stage is during the time of extrusion of the gut into the yolk sac, thereby, forming the physiological hernia, and it ends with the return of the intestines to the abdominal cavity. This return takes place about the tenth week or 40 mm. stage of the embryo. The third stage apparently varies and may exist until after birth. The process then is one of fixation of the intestines by peritoneal absorption and of peritoneal thickening.

It is interesting to consider the forces which may influence the second stage of rotation, that is, the return of the intestine into the abdomen. (Fig. 4.) First, the pressure of the enlarging liver tends to force the

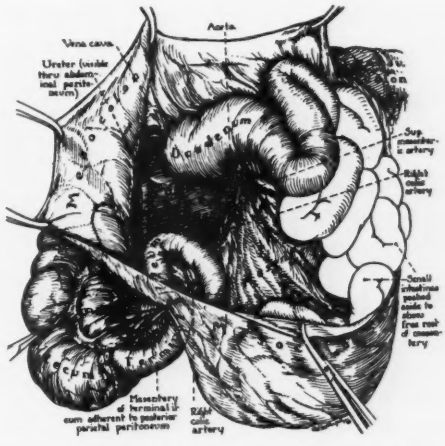

Fig. 4. Drawing of the contents of the intra-abdominal sac at autopsy showing the relation of the duodenum to the superior mesenteric artery and the terminal ileum to the dextrocolic artery. (From Haymond and Dragstedt.)

upper, pre-arterial loop of intestine downward. A second force is the upward pull and fixation of the hindgut at the future splenic flexure. Third, is the early duodenomesenteric tissue which pulls medially on the first parts of the duodenum. These three have been thoroughly discussed by writers on the subject. But a fourth possible influence is adhesion of the intestine to the yolk sac itself. Adhesion would tend to inhibit the return of the gut or take a part or all of the lining of the yolk sac with it. A fifth mechanism is the size of the umbilical opening in the embryo. At this stage the abdominal wall is closing rapidly and the rate of its closure might alter the intestinal return. A large opening might allow a premature re-entrance and malposition. A small opening may cause a delay and possible adhesions to the yolk sac. Still a sixth factor must be considered in the amniotic fluid which will exert an external pressure on the yolk sac. Should the fluid be excessive there will be an increased force in the direction of the return; whereas a lack of amniotic fluid development would reduce the external pressure on the yolk sac and

the return delayed, allowing time for abdominal wall closure and possibly adhesions of the gut to the yolk sac.

There has been speculation as to the manner and rapidity of the return of the intestine to the cavity. The majority of writers describe the return as rapid and that the small intestine enters first and occupies the abdominal cavity most deeply in first the right and then left regions. The cecum and terminal ileum are the last to return and superficially find their place normally in the right lower quadrant.

A disarrangement or imbalance of any of the described forces may account, not only for the marked anomalies of nonrotation or malrotation, but may be responsible for the extreme variations seen in the shape and position of the intestinal tract of adults. For example, on the rapidity of liver growth depends the degree of depression on the pre-arterial loop of intestine and influences the age at which the future small intestine is pressed downward. The traction band at the splenic flexure, through its size, may not only allow a mobile gut, but by varying tension may distort the transverse colon into the "M" and "U" shapes that are found. The duodenal traction band described by Mall, through its length or absence, may account for the redundancy of the duodenum. The possible accelerating or retarding influence of the umbilical opening size and amniotic fluid pressure might easily distort the normal position of the intestine as they return. A slightly prolonged second stage of rotation might allow some adhesions of the gut to the yolk sac lining and results in a delayed return.

When one considers the balance of forces necessary to produce what is called rotation of the normal intestinal tract, it is not remarkable that we find occasional anomalies and frequent variation, but rather, that we obtain the regularity of design encountered. Yet, by 1934, Gardner and Hart[15] had collected only 105 cases in which these congenital difficulties caused obstruction. They found 52 per cent had occurred in newborn infants with symptoms of obstruction beginning within a few days after birth. The remainder, with various intestinal symptoms, ranged up through the third decade of life.

Surgically, these cases of faulty, embryological intestinal rotation are met with. The simplest forms are the redundant ceci and peculiarly shaped transverse colons. Kantor,[16] in extensive *x*-ray and clinical studies has emphasized the fact that intestinal function is interfered with to varying degrees in the majority of these cases of minor malposition. Embarrassing, surgically, are the left-sided colons and the high, abnormally placed appendices. There may be complete retroperitoneal position of the colon, eleven cases of which have been collected by Truesdale.[17] The most tragic difficulty is that in which there has been a volvulus of the entire midgut, as reported in the first case. And last there is the return of the yolk sac lining with the intestine.

In 1932, Papez[18] expressed the idea that the lining of the yolk sac may return with the intestine, forming the occasionally found third peritoneal sac. His argument, that the anomaly is frequently referred to as the large paraduodenal hernia, is sound. His explanation would cover many of the reported cases such as that reported by Haymond and Dragstedt.[19] (Fig. 5.) However, if Papez' explanation is to be accepted, the prevailing opinion of the intestines' rapid return is substantiated, as these large sacs would be forced to return almost *en masse* when the umbilical orifice is widely open.

Regarding the third stage of rotation of the intestinal tract, that is, the fusion of the peritoneal layers, little is known as to its cause. Why the peritoneum, including the mesentery, should fuse in one location and not in another has not been adequately explained. Vague references to plasmaclasts have been made. No one has satisfactorily explained why certain parts of the peritoneum are absorbed and leave behind only the white line along mesenteric and colon margin.

The two cases reported are definite instances of faulty fusion of the midgut to the posterior wall. In the first case, there was no peritoneal absorption, no fixation, and the entire embryological midgut rotated about the vessels and caused death. In the second case, extensive adhesions, rather widely separated, caused obstruction. This is difficult to explain. If the idea of Papez is correct regarding the entrance of the entire lining of the yolk sac to the abdomen to form the occasionally found large paraduodenal hernia or the third peritoneal layer; it is possible that the dense, isolated adhesions encountered in Case II could be the result of adhesions of the intestine in isolated localities and that only a part of the lining of the yolk sac was stripped away and returned with the intestines.

CONCLUSIONS

1. Two cases of abnormality in the third stage of embryological intestinal rotation are presented.

2. The possibility of partial yolk sac adherence could account for the abnormal adhesions in the second case and the question is raised.

3. Forces causing intestinal rotation are considered.

REFERENCES

1. Meckel, C. F. History of Medicine. Garrison, F. H. Saunders & Company.
2. Mall, F. P. Development of human intestine and its position in the adult. *Bull. Johns Hopkins Hosp.*, 9: 197, 1898.
3. Arey, L. B. Developmental Anatomy: A Text-Book and Laboratory Manual of Embryology. Philadelphia, 1924. W. B. Saunders Company.
4. Bailey, F. R. Text-Book of Histology. Ed. 7. New York, 1927. William Wood & Company. Bailey, F. R., and Mille, A. M. Text-Book of Embryology. Ed. 4. New York, 1923. William Wood & Company.
5. Broman, Ivar. Normale and Abnorme Entwickling der Menschen, Wiesbaden, 1911. J. F. Bergmann.
6. Dott, N. M. Anomalies of intestinal rotation: their embryology and surgical aspects with report of five cases. *Brit. J. Surg.*, 11: 251, 1923.
7. Cunningham, D. J. Text-Book of Anatomy. Ed. 5, New York, 1921. William Wood & Company.
8. Huntington, G. S. The Anatomy of the Human Peritoneum and Abdominal Cavity. Philadelphia, 1903. Lea Bros. & Company.
9. Jordan, H. E. A Text-Book of Histology. New York, 1924. D. Appleton & Company.
10. McMurrich, J. P. The Development of the Human Body. Ed. 7, Philadelphia, 1923. P. Blakiston's Son & Company.
11. Frazier, J. E. and Robbins, R. H. On factors concerning the rotation of the intestine in man. *J. Anat. & Phys.*, pp. 50–75, 1915.
12. Pernkopf, Eduard. Die Entwicklung der For, des Magen-Darm-Kanales beim Menschen. *Ztschr. f. d. ges. Anat.*, 85: 1, 1928.
13. Hertzler, A. E. The Peritoneum, St. Louis, 1919. C. V. Mosby Company.
14. Prentiss, C. W. and Arey, L. B. A Laboratory Manual and Text-Book of Embryology, Ed. 3. Philadelphia, 1922. W. B. Saunders Company.
15. Gardner, C. E., Jr. and Hart, Deryl. Anomalies of intestinal rotation as a cause of intestinal obstruction. *Arch Surg.*, 29: 942–981, 1934.
16. Kantor, John L. Common anomalies of duodenum and colon: their practical significances. *J. A. M. A.*, 97: 1785–1790, 1931.
17. Truesdale, P. E. Retroposition of the transverse colon. *J. A. M. A.*, 104: 1697–1700, 1935.
18. Papez, Jas. W. A rare intestinal anomaly of embryonic origin. *Anat. Rec.*, 54: 197–215, 1932.
19. Haymond, H. E. and Dragstedt, Lester E. Anomalies of intestinal rotation. *Surg., Gynec. & Obst.*, 53: 316–329, 1931.

GAS GANGRENE TREATED WITH SULFATHIAZOLE AND ZINC PEROXIDE

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SULFONAMIDE therapy, both general and local, is useful in the treatment of gas gangrene. It retards the progress of the infection although it does not destroy the anerobic bacilli causing it. These bacilli are best destroyed by nascent oxygen. Zinc peroxide paste inserted into the wound slowly releases its extra molecule of oxygen directly into the area of infection. This free oxygen gradually permeates the gas infection and kills the anerobic organisms. Therefore, sulfonamide therapy combined with the use of zinc peroxide paste makes a very effective method of treating gas gangrene.

The following case demonstrates the successful result of the treatment of gas gangrene with sulfathiazole and zinc peroxide:

CASE REPORT

A white male, R. K. D., No. 17337, age twenty-six, was admitted to Pennock Hospital on October 22, 1941, about 3:00 P.M.

The patient gave the following history: While grinding tomato seeds, he slipped and fell into the tomato grinder causing severe lacerations of the left hand. Due to the damp weather some of the seeds were rotten and moldy with an unusual amount of soil adhering to the seeds.

Routine first aid treatment was given: soap, water, alcohol and merthiolate. The laceration was repaired with subcutaneous plain catgut No. 1 and silk sutures in the skin. He was given 1,500 units of tetanus antitoxin and 1,000 units of mixed gas gangrene antitoxin. Repair was done under a 2 per cent procaine local anesthetic. A sterile dressing was applied and the patient sent home.

At 2:00 P.M. October 23rd, the patient was admitted to Pennock Hospital with the hand badly swollen and painful. He was immediately put on sulfathiazole 0.5 Gm. every four hours. His temperature ranged from 101.6 to 103.4°F. On October 24th, his white blood count was 23,000 with polymorphonuclears 89 per cent. Three sutures were removed and the wound probed with no drainage. On October 25th, the swelling of the hand had definitely increased. The sutures were all removed and the wound entirely opened with no drainage.

The appearance of the hand at this time suggested gas gangrene. The wound was irregated with 1.3000 potassium permanganate and continuous hot magnesium sulfate dressings.

An *x*-ray of the left hand and forearm was ordered which was reported by Pennock Hospital *x*-ray consultant, Dr. W. O. Upson, the following day. *X*-ray examination at this time showed a large amount of gas in the soft tissue of the hand, especially near the metacarpal bones of the ring and little fingers. The appearance was characteristic of gas infection. There apparently was no involvement of the bone or periosteum. On October 26th, the left hand and forearm were *x*-rayed in the morning and showed a definite picture of gas gangrene.

An industrial surgeon was called in consultation and in his opinion it was not definitely gas gangrene. *X*-rays were repeated again that afternoon to note progress. *X*-ray report was that the gas infection was extending some into the fingers, especially the small finger. Consultation advised packing the wound with sulfanilamide powder 4.0 Gm., increasing sulfathiazole to 1.5 Gm. every four hours, blood culture and culture of wound for anerobic bacilli.

On October 27th, the hand showed no improvement. *X*-ray therapy was given of 5 milliamperes 85 peak kilovoltage for five minutes at 20 cm. with a field of 10 cm., dosage 360 roentgens, filter of aluminium of 1 mm. thickness. The anerobic culture with the Wright method, at the end of twelve hours,

was positive for gas, and Gram's stain showed Gram-positive encapsulated bacilli. Here was the bacteriologic proof that we were dealing with gas gangrene. The wound was irrigated with hydrogen peroxide and packed with 4.0 Gm. of sulfanilamide powder and moist dressings of potassium permanganate were continued.

Fig. 1. *X*-ray of left hand and forearm taken October 28, 1941. This shows extensive gas infection in the soft tissues on both sides of the fourth and fifth metacarpals, around the fourth metacarpophalangeal articulation, and around the proximal and middle phalanges of the small finger.

On October 28th, the daily *x*-ray showed the gas infection gradually increasing. Sulfonamide level showed 5 mg. per cc. of blood, so the sulfathiazole 1.5 was continued. In spite of the sulfonamide therapy the infection was progressing. An incision was made on the palmar surface between the small and ring fingers to old wound, with no drainage. The wound was irrigated with hydrogen peroxide. The patient had profuse diaphoresis and his general condition was poor. The wound again was packed with 4.0 Gm. of sulfanilamide powder and the potassium permanganate moist dressings continued.

On October 29th, *x*-ray showed the gas infection still slowly progressing. The little finger was now completely gangrenous. With the previous sulfonamide therapy the usual rapidity of progress of the gas infection had been greatly impeded but there had been no decrease of the infection.

At this time zinc peroxide powder that had been sterilized for four hours at 140 degrees temperature was made into a paste with sterile water. Small strips of sterile gauze were saturated with this paste and packed deeply into the wound. The moist potassium permanganate dressings were continued; sulfanilamide powder in the wound was discontinued.

On October 30th, *x*-ray was taken and a definite decrease of the gas was noted. The gauze strips were removed in a hard cast-like form. The wound was irrigated with hydrogen peroxide and again packed with sterile gauze saturated with zinc peroxide paste. On October 31st, November 1st, 2nd and 3rd the dressings were changed and the zinc peroxide paste treatment used each day. Daily *x*-rays showed a continuous decrease in the gas infection. The general comfort of the patient was markedly improved.

The little finger, having become completely gangrenous, was removed when the dressing was done on November 4th. The gangrene was so extensive that no anesthetic was necessary.

On November 5th, the wound was packed again with zinc peroxide paste. *X*-ray showed no evidence of gas. The pockets showing in the *x*-ray were air, as the wound at this time was completely open, due to the packing and tissue slough.

On November 6th, the packing of zinc peroxide paste was removed and thereafter the wound was treated as an ordinary infection. The daily irrigations of hydrogen peroxide were continued.

FIG. 2. *X*-ray taken October 31, 1941, showing two gauze strips saturated with zinc peroxide paste inserted into the soft tissues. Both of these were through, from the dorsum at the proximal ends, to the webs at the distal ends. This *x*-ray shows forty-eight hours of treatment with this procedure and already very little evidence of gas infection.

On November 7th, the patient was allowed to sit up in a chair for ten minutes. His condition was improving rapidly and he was removed from isolation. He was soon up in a wheel chair and then walking around. On November 12th, the fifth metacarpal bone was removed. The next day the patient was removed into the ward. On November 15th, the fourth metacarpal was removed and the following day the patient was discharged from the hospital. Drainage was slight, the wound gradually filled in and healed completely.

On February 18, 1942, the patient was admitted to Pennock Hospital. On February 19th, the left ring finger was amputated because of complete lack of function and plastic repair

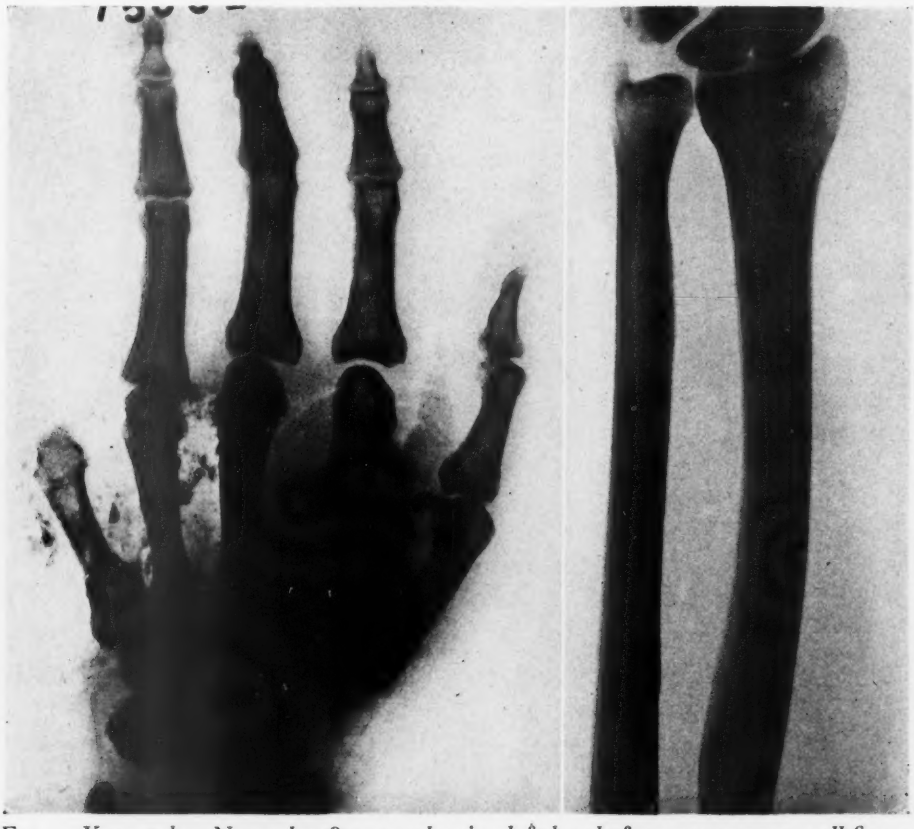

Fig. 3. *X*-ray taken November 8, 1941, showing left hand after gangrenous small finger had been amputated. Dark areas in the soft tissue around fourth and fifth metacarpals are particles of zinc peroxide paste that remained after gauze strips had been removed. There is no evidence of gas infection in this picture. The distal three-fourths of the fifth metacarpal bone had been freed from its surrounding soft tissue by the gas infection and at this time was almost ready to be removed.

was done on the hand. This surgery was done under general anesthesia. Within a period of a few months this man had complete flexion and extension of the thumb, index and middle fingers of this hand.

CONCLUSIONS

1. Sulfonamide therapy, both general and local, is helpful in the treatment of gas gangrene.

2. Sulfonamide therapy does inhibit the progress of gas gangrene but does not destroy the anerobic bacilli.

3. Nascent oxygen is the best destroyer of anerobic bacilli.

4. Zinc peroxide made into a paste and inserted deep into the wound on gauze provides an efficient method of releasing nascent oxygen.

5. Zinc peroxide, in the paste form, releases its extra molecule of oxygen slowly allowing it to permeate into the gas infection.

6. Zinc peroxide paste is our most efficient method of getting nascent oxygen where it is needed.

TRAUMATIC CHYLOUS ASCITES*

CASE REPORT

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ABINGTON, PENNSYLVANIA

THE finding of chylous fluid in the peritoneal cavity at operation is a rather striking, as well as a rare phenomenon. There are two main causes of chylous ascites, or chyloperitoneum: first, disease involving the lymphatics, and second, trauma. Trauma may be due to a penetrating wound or a crushing injury. It is significant to note that the crushing injury may be rather minor in character, and ascites develop some time after the injury, two days to four weeks. So far as we are able to determine there have been very few cases of traumatic chylous ascites reported, and no summary of reported cases has been made. We were able to find only five cases reported.

Traumatic chylothorax, on the other hand, although still rare, is more common than chyloperitoneum, and in July, 1938, Shackelford and Fisher collected and analyzed thirty-nine cases in addition to reporting two of their own.[1] In each of their own cases there was an associated chylous ascites but it was mentioned only once in the other thirty-nine cases. Davis[2] reported five cases of chylous ascites in 1939, two of which were apparently due to trauma. He drained his first patient and closed his second; both recovered. Staly, in 1894, and Hall-Moyer, in 1910, each reported a case in which the patient was treated by repeated paracentesis with recovery. It seems, therefore, that traumatic chylous ascites is either very rare, overlooked, or not reported. Certainly the mortality is lower than that of traumatic chylothorax in which the mortality rate averages 41 per cent (Lillie and Fox[3]). Since the loss of chyle is not prolonged, chemical problems do not enter into the treatment. The appearance of milky fluid, unless mixed with blood should make the diagnosis easy. If mixed with blood, it may give the appearance of creamy pus, but when examined microscopically the large fat globules stain readily with Sudan III. There has been much confusion in the literature regarding the classification and differentiation of milky effusions.

Blankenhorn, in 1923, concluded that the term pseudochylous was misleading and should be discarded. Fifteen years later, Harrell, Street and Reiser in analyzing the liquid contents of their own cases and after experimental work on animals, concluded that the term chylous, chyloform, or pseudochylous apply to the same condition, the difference in appearance of the fluid being due to the size of the fat particles and the relative proportion of lymph, chyle and cellular contents.[4]

It was interesting to note that Wyatt and Gross in reporting a case of chylous ascites in an infant believed that the diagnosis of chylous fluid in the abdomen could be made roentgenographically. The radiopacity of chyle, because of its high fat content, is less than other fluids. Therefore, the visualization of solid abdominal organs surrounded by relatively radiolucent fluid suggests the diagnosis of chylous ascites.

As in the thorax, the presence of chyle after trauma means there has been an injury to the thoracic duct or its radicles, so in the peritoneal cavity it means an injury to the cisternachyli (receptaculum chyli) or its contributories.

* Read before the October 4, 1943, meeting of the Philadelphia Academy of Surgery, Philadelphia, Pa

CASE REPORT

The case being reported is the only one on record at the Abington Memorial Hospital. It is that of a colored man, H. C., age thirty-five, who was admitted to the Pfeiffer Surgical Clinic of the Abington Memorial Hospital on April 4, 1943, complaining of right-sided abdominal pain. He stated that he had been well until the previous day when he developed abdominal pain that seemed to pass from one side of the abdomen to the other across the midline. The pain was aching and crampy in character, and later became right-sided. It hurt him to take a deep breath. The deeper the breath, the worse the pain. He had not vomited and did not have any urinary tract symptoms. He took a laxative the night before admission and had a normal bowel movement in the morning.

At the time of admission there was nothing in his past history that seemed to have any bearing on his present illness. After operation, however, it was learned that he had been in an automobile accident two weeks previously. His car was smashed between a trolley car and a telegraph pole, and he recalled being bumped in the back by the front seat, and pressed against the steering wheel.

Physical examination on admission showed slight distention of the abdomen, mild muscular rigidity, more marked on the right, and tenderness in the right lower quadrant. Peristalsis was active. Otherwise the physical examination was negative with the exception of slight tenderness on rectal palpation that seemed to reproduce abdominal pain. The blood count showed a white blood count of 13,800, but a normal differential. The urine examination was normal. A diagnosis was made by the resident of acute appendicitis, and he was operated upon by Dr. F. M. Simmons Patterson, under spinal anesthesia which was later supplemented by intravenous sodium pentothal.

The operative notes show that a lower right muscle displacement incision was made. On opening the peritoneum, copious amounts of milky fluid exuded. A culture was taken and suction applied. Approximately 600 cc. of fluid was removed, and the entire abdomen explored. The mesentery of the ascending colon was whitish in appearance as was the posterior parietal peritoneum. The stomach and duodenum appeared normal. The mesentery of the entire small bowel showed engorgement of the lymphatic vessels, otherwise the mesentery of the rest of the bowel was normal. The gallbladder was normal in appearance and emptied readily on pressure. The liver, pancreas and spleen appeared normal. There was no enlargement of the mesenteric glands. A diagnosis of chylous ascites was made, but the etiological factor was not determined. Apparently the point of injury was retroperitoneal. The senior surgeons were consulted by the resident, and at Dr. Pfeiffer's suggestion, a routine appendectomy was done with the cautery, the stump inverted, and the abdomen closed in layers without drainage, 5 Gm. of crystalline sulfanilamide being placed in the peritoneal cavity. The patient made an uneventful recovery and was discharged on the eighteenth day after admission. There was no change in the blood chemistry, and the diet was not limited in fats. The urine output was normal in quantity and quality. There was no suggestion of reaccumulation of fluid in the abdomen, and the chest remained clear. An *x*-ray taken showed no evidence of bone injury to the spine.

The patient stated that he felt well until about three months later when he was seized with abdominal pain, crampy in character. He stood it for two days and then came back to the hospital on July 3, 1943, with most of the signs of small bowel obstruction; abdomen distended, projectile vomiting, fecal in character, tinkling peristalsis with rigidity and rebound tenderness. A flat *x*-ray plate in the upright position showed fluid levels in the small bowel low in the pelvis. He appeared dehydrated, although his chemistry and blood count were within normal limits. Intravenous therapy of glucose and saline was instituted at once and a double lumen tube was introduced.

He improved greatly under this treatment. His blood count remained normal and he was always in chemical balance, but he remained obstructed. So on the sixth day after admission a laparotomy was performed under spinal anesthesia. Exploration showed no increase in the peritoneal fluid, and what little there was, was clear. The Miller-Abbott tube could be palpated down to a point in the ileum. From this point on the ileum was dilated. The ileocecal area was enmeshed in adhesions and attached to the parietal peritoneum. Several loops of terminal ileum were bound together

by adhesions, and the omentum was likewise adherent to this area. The immediate site of the previous appendectomy appeared to be in good condition. No lesions were demonstrated in the bowel. Lysis of adhesions was performed with scissors, relieving the obstruction. The wound was closed in layers without drainage. The patient again made an uneventful recovery and was discharged on the thirteenth postoperative day. He has remained well to date.

CONCLUSIONS

1. A case of chylous ascites due to trauma is reported.

2. Chylous peritoneum following trauma is rare.

3. It is less serious than chylothorax.

4. Laparotomy with removal of the fluid followed by closure seems to be satisfactory treatment.

5. The cause of the postoperative adhesions in our case may be a subject of the controversy. A culture of the fluid found in the peritoneum at the time of first operation was sterile. We believe that the sulfanilamide probably was responsible for the adhesions found at the second operation.

REFERENCES

1. Shackelford and Fisher. Traumatic chylothorax. *South. M. J.*, 31: 766–774.
2. Davis. Chyle ascites. *Pennsylvania M. J.*, 43: 142–148, 1939.
3. Lille and Fox. Traumatic intrathoracic rupture of the thoracic duct with chylothorax. *Ann. Surg.*, 101: 1367–1376, 1935.
4. Harrell, Street and Reiser. Chylothorax and chylous ascites; report of case with liquid analyzed, *J. Lab. & Clin. Med.*, 24: 1045–1050, 1939.
5. Wyatt and Gross. Chylous ascites. Roentgenologic observations from case in infancy. *Am. J. Roentgenol.*, 45: 848–849, 1941.
6. Little, Harrison and Blalock. Chylothorax and chyloperitoneum: effects of reintroduction of aspirated chyle. *Surgery*, 11: 393–409, 1942.
7. Buchanan. Chylous ascites: three cases. *Ann. Surg.*, 110: 140–143, 1939.

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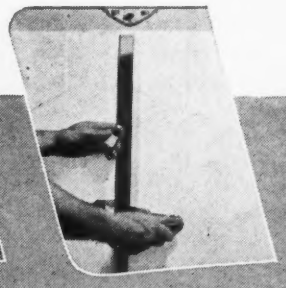
For the usual concentration (5000 Oxford Units per cc.) inject 20 cc. of physiologic salt solution into the vial in the usual aseptic procedure.

Invert the vial and syringe (with needle in vial), and withdraw the amount of penicillin solution required for the first injection.



Store vial with remainder of solution in refrigerator. Solution is ready for subsequent injections during the next 24 hours.

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rubber stopper in the customary manner, inject into the vial 20 cc. of pyrogen-free, sterile physiologic salt solution; without removing the needle invert vial and withdraw as many cc. of this 5000 units per cc. solution for the injection that is to be made immediately; store the vial with its remaining solution in the refrigerator—it is ready for use when the next injection is to be made.

The concentration withdrawn from the vial is 5000 units per cc. If a lower concentration is desired, modification is easily accomplished.

If you have not as yet received a copy of the "Penicillin-C.S.C. Therapeutic Reference Table," showing dosages, modes of administration, and duration of treatment required in the various infections in which penicillin is indicated, write for a complimentary copy now. You will find it a valuable guide and a real aid in familiarizing yourself with penicillin therapy.

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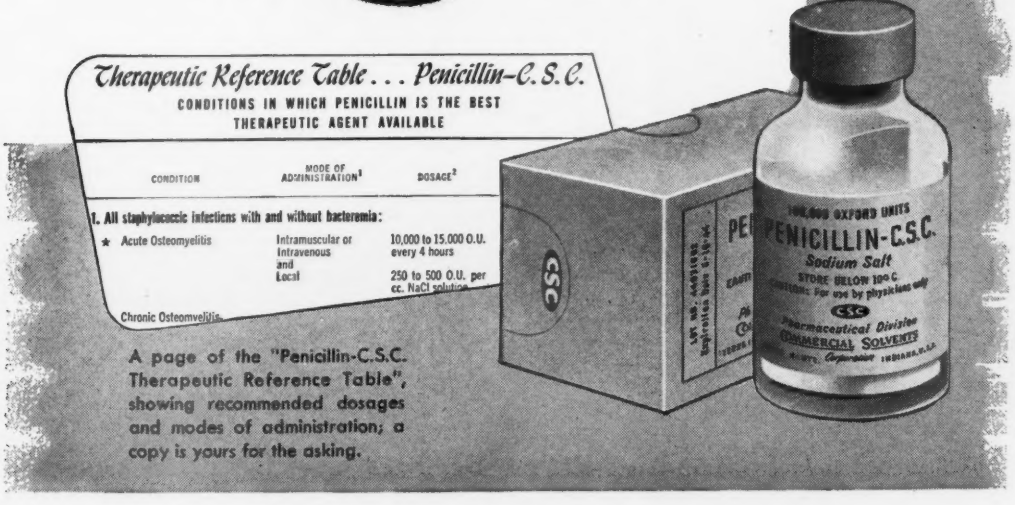
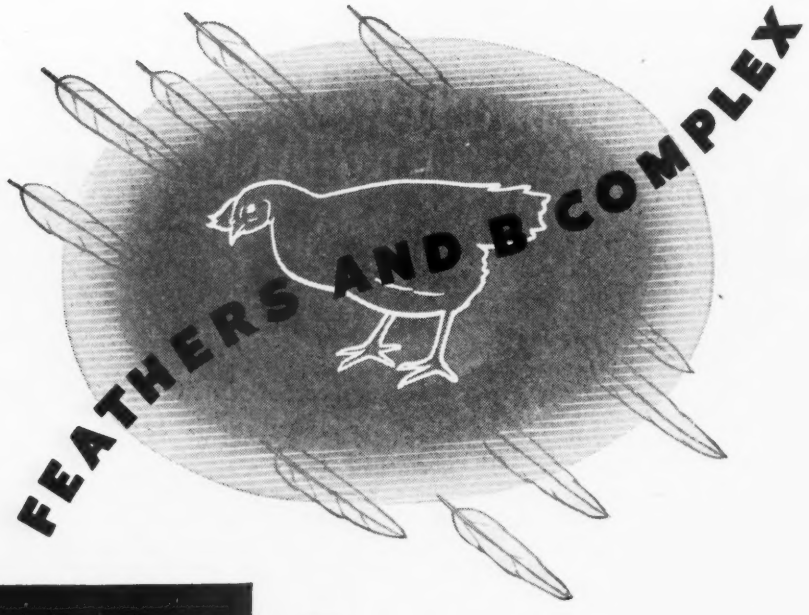


A page of the "Penicillin-C.S.C. Therapeutic Reference Table", showing recommended dosages and modes of administration; a copy is yours for the asking.



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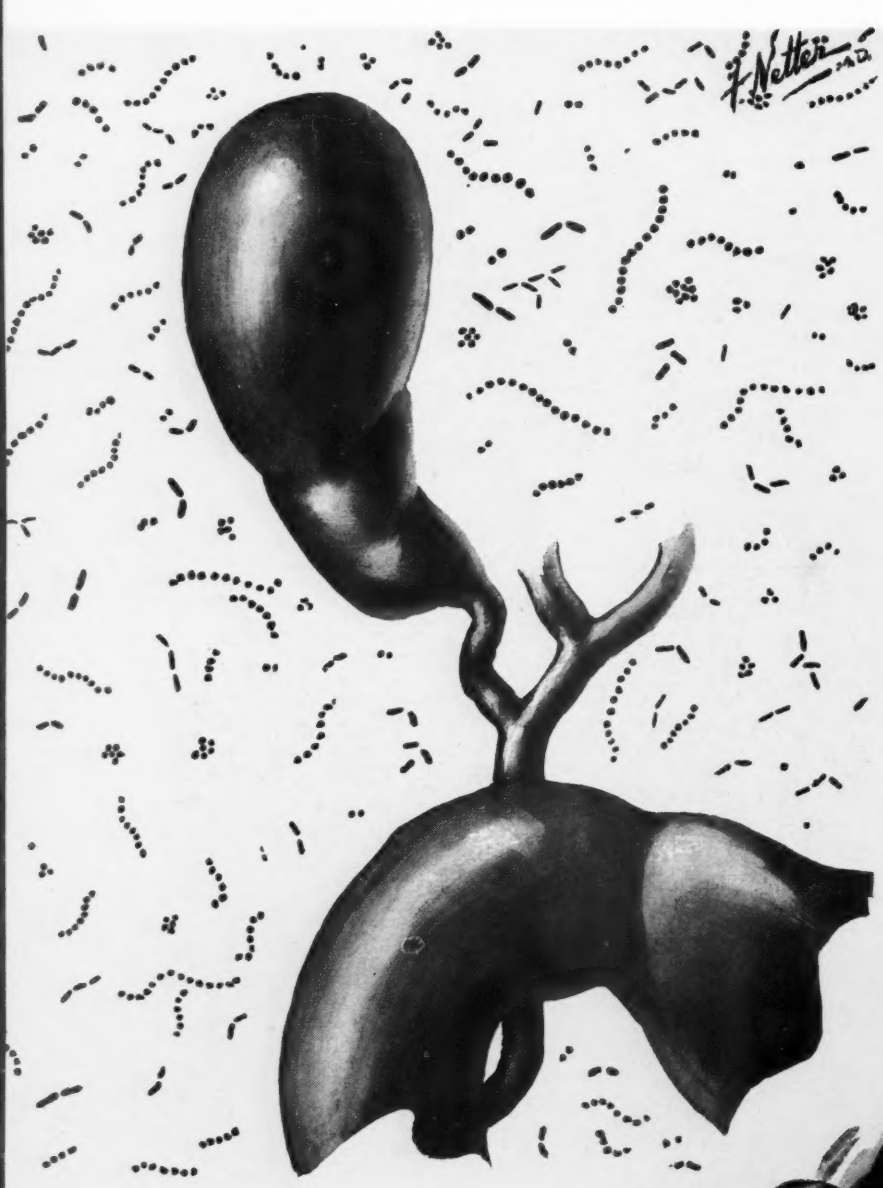

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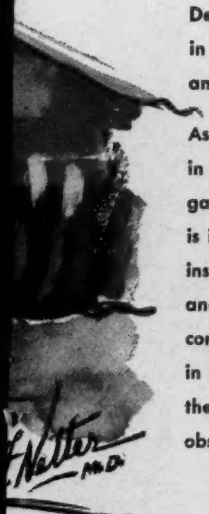

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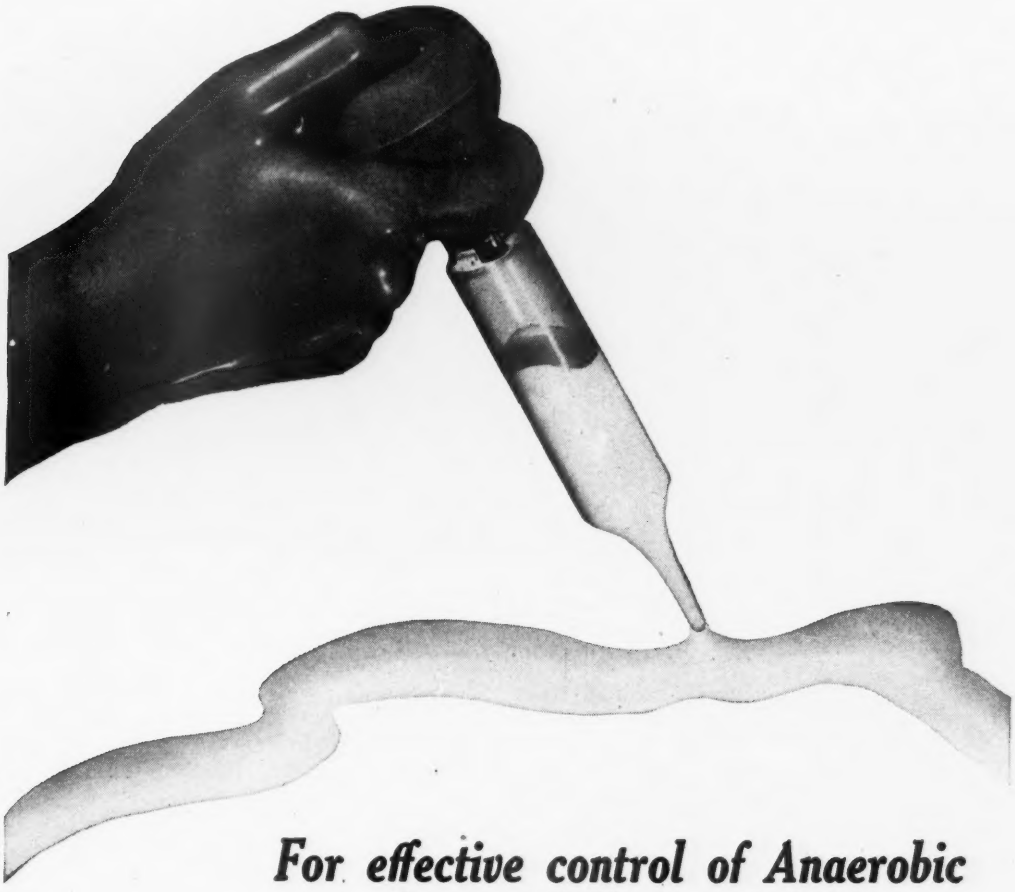

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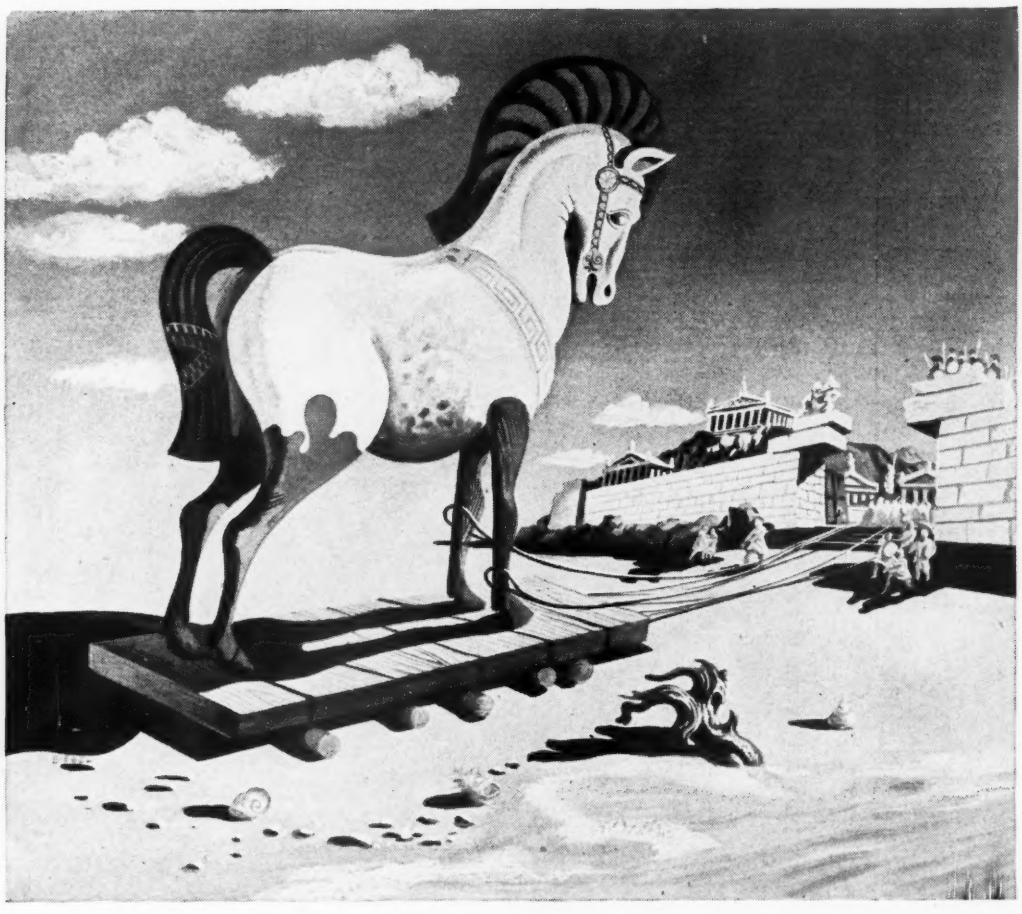

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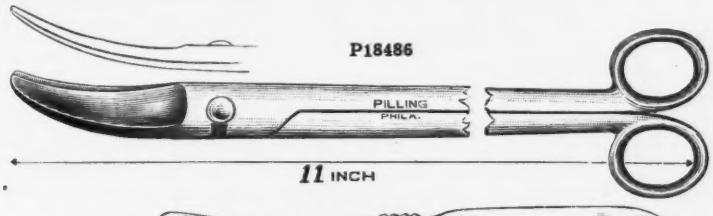

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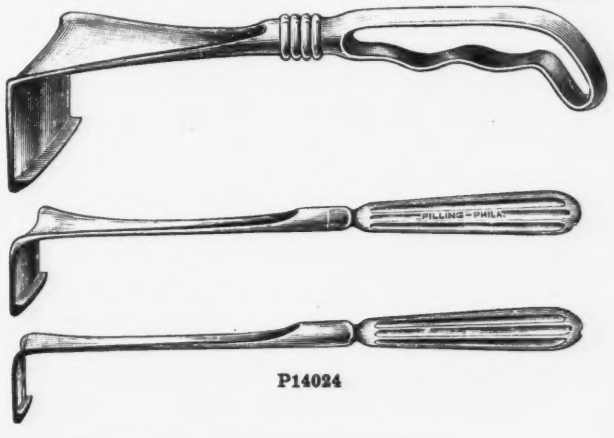

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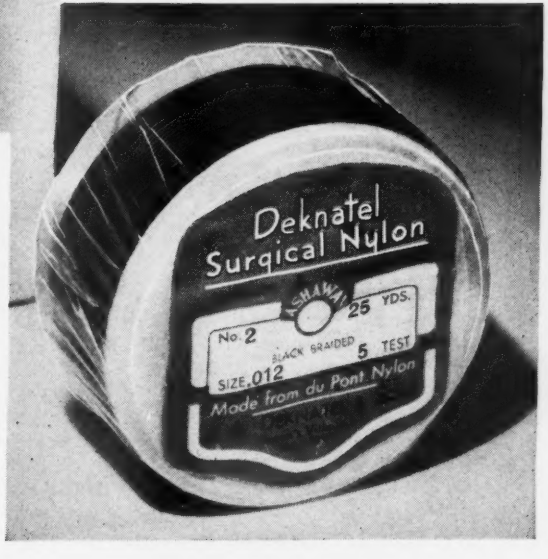

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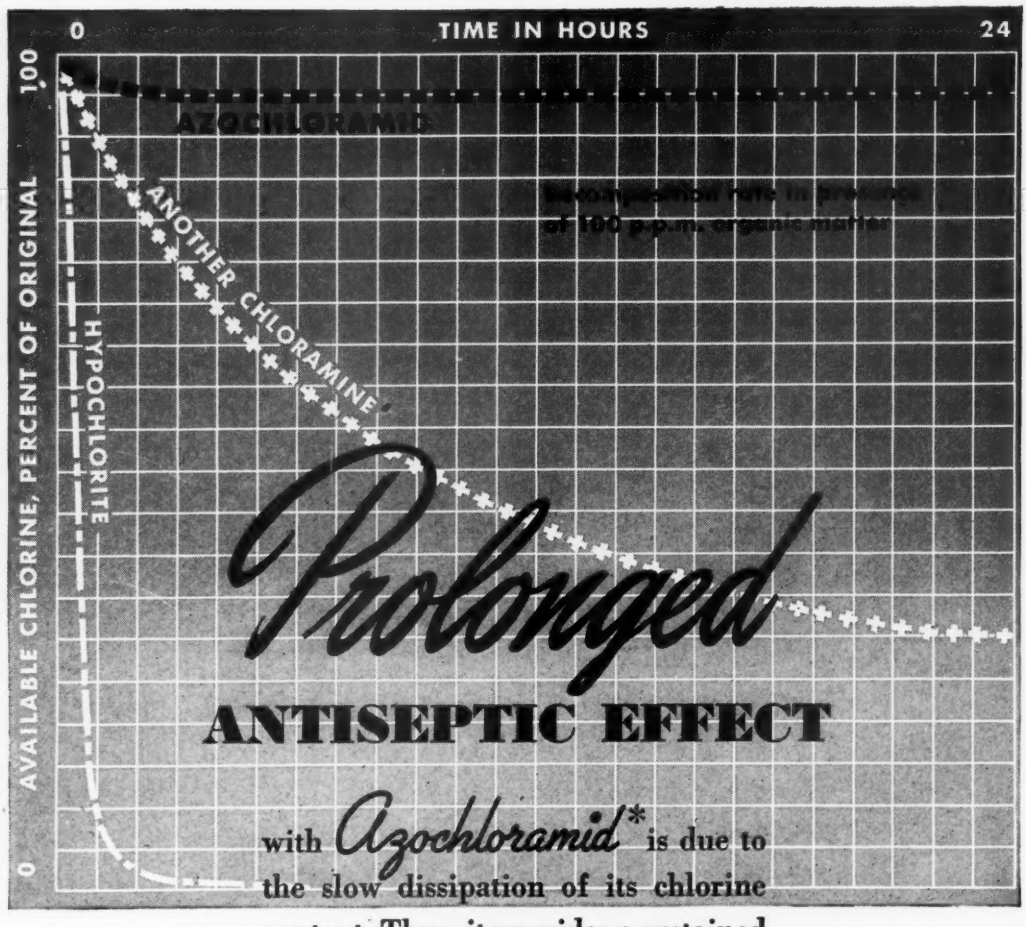

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Normal Strength

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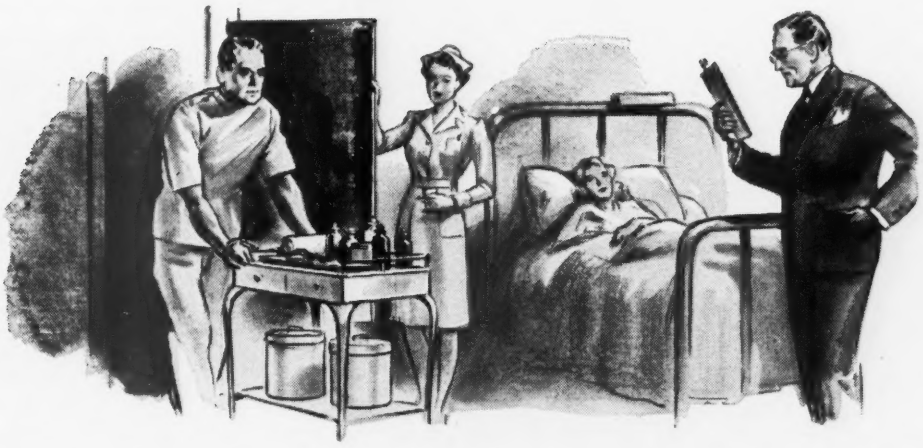
CALCIUM . . .	.25 Gm.	1.104 Gm.	RIBOFLAVIN .	.25 mg.	1.278 mg.
PHOSPHORUS .	.25 Gm.	.903 Gm.	NIACIN . . .	3.0 mg.	5.0 mg.
IRON	10.5 mg.	11.94 mg.	COPPER . . .	.5 mg.	.5 mg.

*Each serving made with 8 oz. milk; based on average reported values for milk.

IN THE PREVENTION OF

Postsurgical Anemia



Not only the drain of the surgical procedure itself, but the anorexia following it and the frequently resultant nutritional impairment make antianemic therapy a valuable aid toward speedier return of normal strength and stamina. Livitamin, combining readily available iron, high potencies of the essential B-vitamins, and liver concentrate, in a palatable liquid vehicle, promptly improves the appetite, aids food utilization, and prevents or corrects the anemic state.

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Pyridoxine Hydrochloride (B_6)	0.187 mg.
Pantothenic Acid	2.315 mg.
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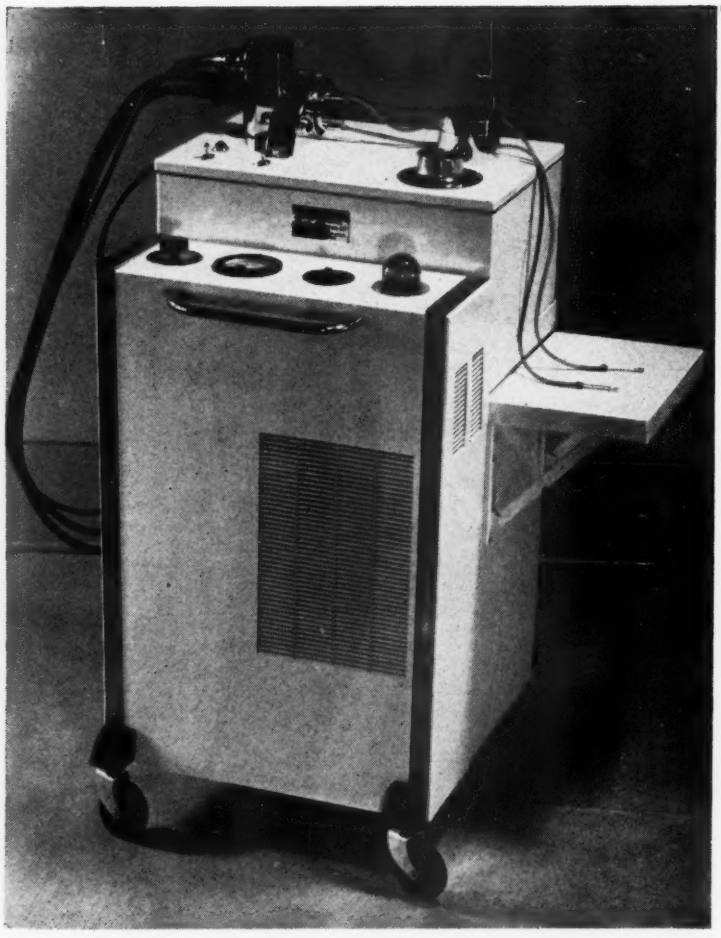

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Irradiated Blood Transfusion in the Treatment of Infections *Northwest Med., June* 1934

The Ultraviolet Irradiation of Auto-transfused Human Blood; Studies in Oxygen Absorption Values *Am. Jl. of Med. Scs., June* 1939

The Irradiation of Autotransfused Blood by Ultraviolet Spectral Energy; Results of Therapy in 110 Cases: *M. Clin. North America, May* 1940

Ultraviolet Irradiation of Autotransfused Blood in the Treatment of Puerperal Sepsis *Am. Jl. Surg., Dec.* 1941

The Knott Technic of Ultraviolet Blood Irradiation in Acute Pyogenic Infections *New York State Jl. Med., Jan.* 1942

Ultraviolet Irradiation of Autotransfused Blood in the Treatment of Postabortional Sepsis: *Am. J. Surg., March* 1942

Ultraviolet Blood Irradiation Therapy (Knott Technic) in Acute Pyogenic Infections *Am. J. Surg., Sept.* 1942

Double Septicemia Following Prostatectomy Treated by the Knott Technic of Ultraviolet Blood Irridation *Am. J. Surg., Sept.* 1942

Treatment of Blood Stream Infections with Hemo-Irradiation: *Am. J. Surg., Dec.* 1942

Ultraviolet Blood Irradiation Therapy *Tr. Am. Therap. Soc., Vol. XLII* 1942

The Knott Technic of Ultraviolet Blood Irradiation as a Control of Infection in Peritonitis *Rev. Gastroenterol., Jan. Feb.* 1943

Ultraviolet Irradiation of Blood in the Treatment of Escherichia Coli Septicemia: *Arch. Phys. Therapy., March* 1943

The Control of Acute Thrombophlebitis with Ultraviolet Blood Irradiation Therapy *Am. J. Surg., June* 1943

Preoperative Hemo-Irradiations *Am. J. Surg., Aug.* 1943

Preliminary Report of Results Observed in Eighty Cases of Intractable Bronchial Asthma: *Arch. Phys. Therapy, Sept.* 1943

Ultraviolet Blood Irradiation Therapy: *Arch. Phys. Therapy, Sept.* 1942

Disappearance of Hemolytic Staphylococcus Aureus Septicemia Following Ultraviolet Blood Irradiation Therapy: *Am. J. Surg., Nov.* 1943

Five Years Experience with Hemo-Irradiation According to the Knott Technic: *Am. J. Surg., July* 1943

The Present Status of Ultraviolet Blood Irration Irradiation (Knott Technic). *Arch. Phys. Therapy, June* 1944

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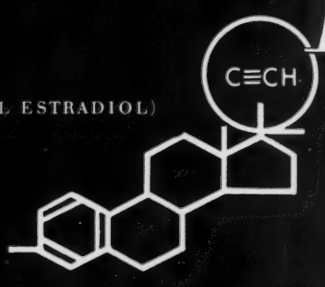

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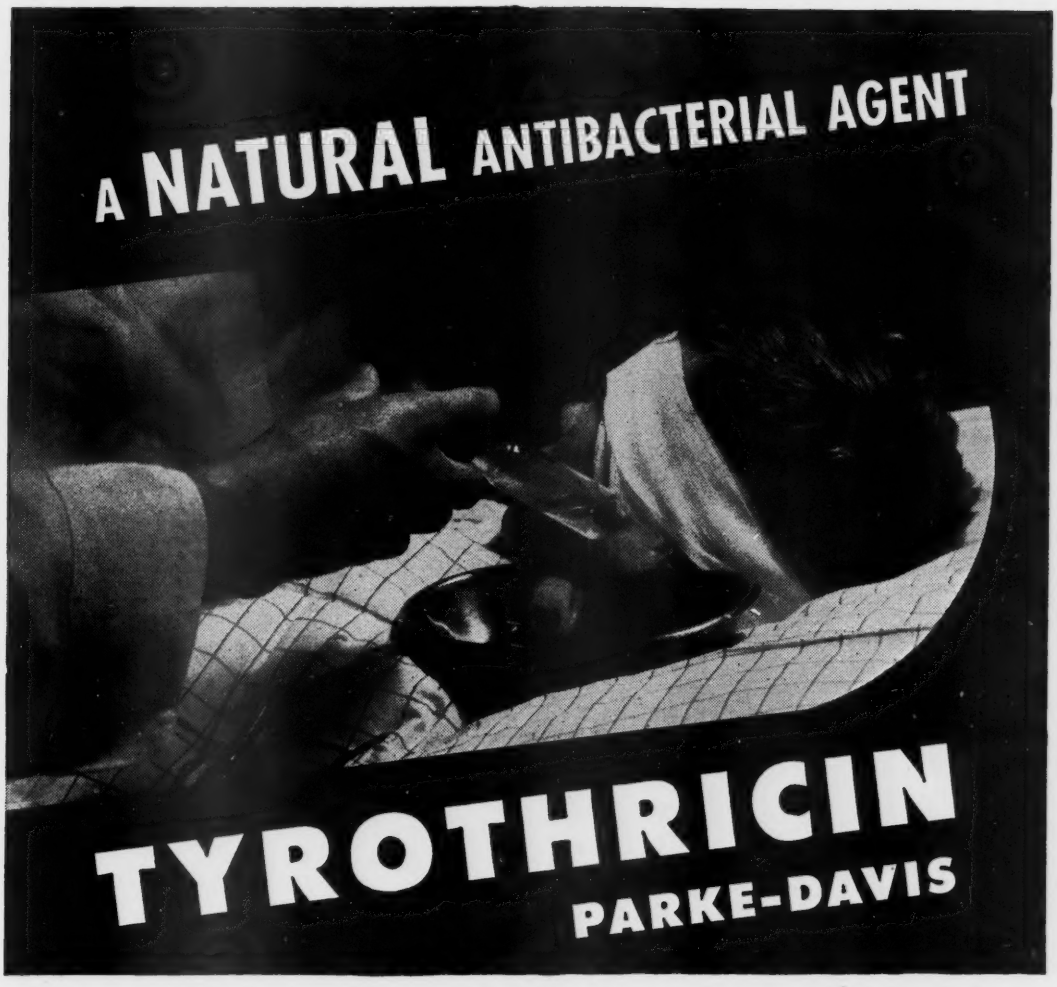

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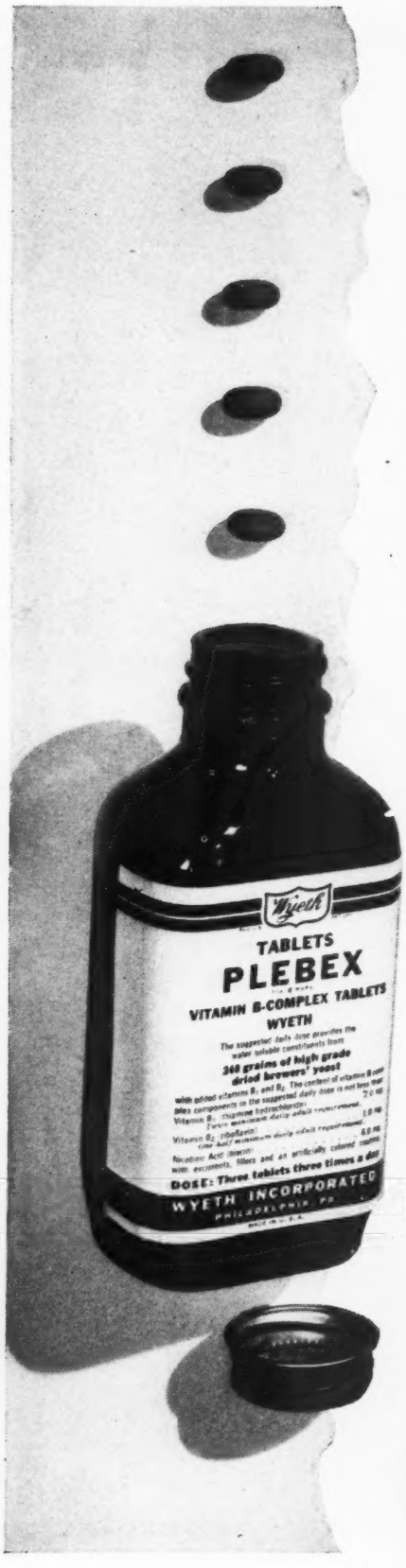

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[1] Bickind, G. R.: Proc. Soc. Exper. Biol. & Med. 43:239, 1940. Burrill, M. W. and Greene, R. R.: Endo. 31:73, 1942.

[2] Lisser, H. and Curtis, L. E.: J. Clin. Endo. 3:289, 1943.

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